Journal of Management & Organization (2020), **26**, 700–718
© 2018 Cambridge University Press and Australian and New Zealand Academy of Management
doi:10.1017/jmo.2017.85

The curvilinear relationship between team familiarity and team innovation: A secondary data analysis

XIAO-YUN XIE,* HAO JI,* KUN LUAN** AND YING-ZHEN ZHAO§

Abstract

Paradoxical arguments and mixed empirical evidence coexist in the current literature concerning the relationship between team familiarity and team innovation. To resolve this contradiction, we apply habitual routines theory to propose that team familiarity and team innovation have an inverted U-shaped relationship. Using a data set of 68,933 R&D teams in the electrical engineering industry, our results support a nonlinear relationship between team familiarity and team innovation, and suggest that the best innovative performance is produced by moderately familiar teams. Furthermore, we find that external learning can moderate this curvilinear relationship. Theoretical contributions and future implications are discussed.

Keywords: team familiarity, team innovation, external learning, R&D teams, electrical engineering industry

Received 7 March 2017. Revised 11 December 2017. Accepted 21 December 2017.
First published online 1 February 2018

INTRODUCTION

Innovation has become increasingly important for contemporary organizations to survive and gain competitive advantages (Anderson, Potočnik, & Zhou, 2014). Given that team working increasingly becomes a critical practice to improve organizational innovation (Hülsheger, Anderson, & Salgado, 2009), managers have been looking for optimal ways to improve team innovation (e.g., Gebert, Boerner, & Kearney, 2010). However, they often face dilemmas in practice. For example, many organizations are interested in bringing experts from different functions to carry out an innovative task in short term, but these teams are likely to suffer process losses and coordination problems (e.g., Edmondson & Nembhard, 2009). Other organizations rely on intact teams to realize their innovative goals, however, these teams are sometimes found to be hindered by shortage of novel ideas (e.g., Katz, 1982).

Team familiarity, defined as the extent to which team members share accumulated experience in working together (Huckman, Staats, & Upton, 2009; Sieweke & Zhao, 2015), clearly has an important effect on team processes and innovation. Unfortunately, there is presently no consensus in theoretical arguments regarding the relationship between team familiarity and team innovation. Some experts feel that assigning individuals who are familiar with each other to work on innovative efforts

* School of Management, Zhejiang University, Hangzhou, Zhejiang, China
** School of Economics and Management, China University of Petroleum, Qingdao, Shandong, China
§ Health Management School, Hangzhou Normal University, Hangzhou, Zhejiang, China
Corresponding author: luankun@zju.edu.cn

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

may be an appropriate approach. In support of this view, many researchers propose that team familiarity helps teams to integrate diverse knowledge, develop shared understanding and coordinate teamwork (e.g., Harrison, Mohammed, Mcgrath, Florey, & Vanderstoep, 2003; Taylor & Greve, 2006; Savelsbergh, Poell, & van der Heijden, 2015), thereby enabling teams to transform diverse ideas into new products or solutions (e.g., Akgün & Lynn, 2002; Akgün, Byrne, Keskin, Lynn, & Imamoglu, 2005). However, familiarity may also trigger a loss of innovation. For example, many researchers suggest that team familiarity is likely to attenuate communication and restrict constructive debates within the team (e.g., Katz, 1982; Slotegraaf & Atuahene-Gima, 2011; Sieweke & Zhao, 2015). Such limited interaction may hinder the generation of new ideas and innovative solutions (e.g., Choi & Thompson, 2005; Nemeth, & Ormiston, 2007).

The empirical evidence on this question is similarly contradictory. Several studies report that team familiarity is positively related to team innovation (e.g., Taylor & Greve, 2006; Gajendran & Joshi, 2012; Post, 2012). Other studies show that team familiarity is negatively associated with team innovation (e.g., Ziller, Behringer, & Goodchilds, 1962; Liu, Chen, & Tao, 2015). Moreover, numerous studies find no significant relationship between team familiarity and team innovation (e.g., Chi, Huang, & Lin, 2009; Hu & Randel, 2014), even in the case of meta-analysis (Hülsheger, Anderson, & Salgado, 2009).

A plausible explanation for these divergent perspectives and results is that the relationship between team familiarity and team innovation might be curvilinear. To elaborate, various studies have shown that team innovation encompasses both the generation and the implementation of ideas (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Sheremata, 2000; Anderson, Potočnik, & Zhou, 2014). These two processes are to some extent paradoxical, but complementary. The absence of either process makes team innovation impossible (Sheremata, 2000; Gebert, Boerner, & Kearney, 2010). According to habitual routines theory (Gersick & Hackman, 1990), teams with a high degree of familiarity are likely to develop habitual routines and effective coordination, but such familiarity often hampers creative thinking. If the level of team familiarity is low, team members may feel free to propose diverse viewpoints, but they may have less capacity for cooperation in achieving an innovative result. Overall, neither low nor high levels of team familiarity yield team innovation. Only a moderate level of team familiarity can foster the best performance in team innovation, because moderate familiarity maintains idea generation and implementation in a proper balance. Therefore, the relationship between team familiarity and team innovation may exhibit an inverted U-shape.

It is difficult to make changes and keep innovative by the long-standing team itself. We respond to this problem by introducing team external learning as a possible moderator for the curvilinear relationship between team familiarity and innovation. We propose that external learning may attenuate and buffer the negative effects of team familiarity, without significantly disrupting existing team coordination. To test our hypotheses, we conducted an archival study with a sample of 68,933 R&D teams in the electrical engineering industry from a patent database. The results support an inverted U-shaped relationship between team familiarity and team innovation, and the moderating effect of external learning on this relationship.

This study contributes to relevant research literature in two ways. First, we contribute to team innovation research by reconciling the paradoxical arguments and contradictory evidence on the relationship between team familiarity and team innovation. It is suggested that team familiarity is an important antecedent concerning team processes and outcomes (Goodman & Leyden, 1991), however, previous studies cannot reach a consensus regarding the effect of team familiarity on team innovation. Based on habitual routines theory, our study directly tests the relationship between team familiarity and innovation with a large sample, and finds an inverted U-shaped relationship between the two, in so doing the theoretical and empirical contradictions are, to some extent, reconciled.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Second, our study extends habitual routines theory by exploring the influence of external learning on changes to habitual routines. As habitual routines theory (Gersick & Hackman, 1990) suggests, situational novelty is more likely to initiate a change of habitual routines. In line with this reasoning, we investigate whether external learning activities can serve as effective channels for teams to expand their awareness of new situations, and to introduce novelty to internal routines, thereby achieving innovation without sacrificing the capacity for teamwork.

THEORY AND HYPOTHESES

The curvilinear relationship between team familiarity and team innovation

Team familiarity is defined as the shared experience that team members have worked together (Reagans, Argote, & Brooks, 2005; Huckman, Staats, & Upton, 2009). Through repeated interactions within their team, team members develop a clear understanding regarding their tasks and teammates (Espinosa, Slaughter, Kraut, & Herbsleb, 2007). Similar concepts include team stability, which concerns the extent to which team members remain together for the duration of the team's lifecycle (Slotegraaf & Atuahene-Gima, 2011). Another related concept is team longevity, which refers to the length of time that team members have worked with each other (Katz, 1982). Most previous studies support the idea that a high level of team familiarity can facilitate team coordination (e.g., Espinosa et al., 2007), team productivity and team efficiency (e.g., Harrison et al., 2003; Huckman, Staats, & Upton, 2009). However, the effects of team familiarity on team innovation are inconclusive.

Team innovation refers to the extent to which a team generates novel and useful ideas, and then applies these ideas to new solutions or products (Amabile et al., 1996; Glynn, 1996). Team innovation encompasses both idea generation and idea implementation (Sheremata, 2000; Gebert, Boerner, & Kearney, 2010; Anderson, Potočnik, & Zhou, 2014). Idea generation denotes the extent to which a team develops and communicates novel ideas among its members, and idea implementation describes the degree to which a team can actually transfer new ideas into products or work processes (Gebert, Boerner, & Kearney, 2010). Idea generation and idea implementation are seemingly separate, but they require each other nevertheless. On the one hand, idea generation requires attention to both novelty and usefulness with consideration for the requirements of implementation. On the other hand, new ideas usually cannot be applied by old methods, therefore implementation also requires new thinking on how to achieve novel solutions (Rosing, Frese, & Bausch, 2011). Without idea generation, teams have no fresh ideas to develop new products or processes. Without idea implementation, the pursuit and discussion of new knowledge become a wild goose chase. In considering this interdependent picture, we suggest that idea generation and implementation are complementary and synergistic, both being requisites for innovation (Sheremata, 2000; Gebert, Boerner, & Kearney, 2010).

According to habitual routines theory (Gersick & Hackman, 1990), teams are likely to develop habitual routines when their members recurrently interact with each other, and are familiar with both their tasks and their teammates. Such routine operations enable rules, standards and priorities to be established concerning how work should be done. Familiarity with accepted routines tends to reduce the degree of disagreement and dissent within a team and foster a shared understanding of tasks and teamwork, both of which help idea implementation. Because repeated routines, however, prohibit teams from trial-and-error or divergent thinking, whose importance on idea generation has been indicated by previous literature (Gebert, Boerner, & Kearney, 2010; Rosing, Frese, & Bausch, 2011), we expect that team familiarity is likely to jeopardize idea generation. In total, we propose that team familiarity may benefit idea implementation but hurt idea generation. Next, we state our arguments in greater detail.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Team familiarity is likely to facilitate idea implementation by coordinating teamwork and integrating diverse knowledge. As previously stated, team familiarity can lead to habitual routines (Gersick & Hackman, 1990), and these routines may help team members to develop a shared understanding on which tasks should be completed, or which objectives and standards should be met within specific time periods (Feldman & Rafaeli, 2002; Bresman & Zellmer-Bruhn, 2013). As a result, both the tasks and the temporal structures are clarified. Work can smoothly move from one team member to another, and individual tasks are effectively combined without spending too much time on discussion or instruction.

In support of these arguments, many studies show that team familiarity (or stability) can benefit group coordination (e.g., Espinosa et al., 2007), enhance transactive memory systems (e.g., Akgün et al., 2005) and expedite speed-to-market of new products (e.g., Akgün & Lynn, 2002). Routines also tend to establish collective evaluation standards, which can make it much easier to make decisions when encountering divergent perspectives (Gebert, Boerner, & Kearney, 2010). As evidence for these ideas, several previous studies find that team familiarity is helpful for enabling teams to better utilize diversity for achieving higher performance (e.g., Huckman & Staats, 2011; Gevers, Rispens, & Li, 2016). Given that coordination and integration are both critical in the process of idea implementation (Bledow, Frese, Anderson, Erez, & Farr, 2009; Gebert, Boerner, & Kearney, 2010), it seems clear that team familiarity can directly improve idea implementation.

However, team familiarity may also restrict the opportunities and motivations for challenging old ideas, exploring new possibilities or experimenting with new methods through the force of habitual routines (Gersick & Hackman, 1990). Once habitual routines are established through long-term interaction, team members may be unwilling to change them, because those routines satisfy their needs for safety. Routines comfort people by providing an unambiguous and predictable environment (Katz, 1982). Team members may feel that they are expected to maintain and abide routines or norms by their teammates (Jones & George, 2014: 371). In that case, any attempt to alter their routines can be viewed as introducing an unnecessary risk. Calls for changes and innovation may therefore be resisted or rejected by the team. Therefore, alternative views and new ideas that challenge the *status quo* are unlikely to be expressed or accepted in teams with high levels of team familiarity (Slotegraaf & Atuahene-Gima, 2011). Clearly, too much team familiarity can impede idea generation. In support of the above reasoning, a considerable body of research indicates that excessive familiarity is harmful for teams seeking to adapt in changing and uncertain situations (e.g., Berman, Down, & Hill, 2002; Sieweke & Zhao, 2015), and hinders team creativity (e.g., Ziller, Behringer, & Goodchilds, 1962; Choi & Thompson, 2005).

Because teams need to combine both idea generation and implementation to realize innovation (Sheremata, 2000; Gebert, Boerner, & Kearney, 2010), we conclude the above evidence by proposing that there is a nonlinear relationship between team familiarity and team innovation. As previously stated, when team familiarity is low, habitual routines are underdeveloped within a team. In this condition, team members have enough freedom to generate new knowledge, but they lack shared experience and find it difficult to work together for implementing these ideas, and therefore have a weak performance for team innovation. When the level of team familiarity is high, new ideas can be easily integrated and implemented because shared habitual routines allow shared cognition and effective action plans. However, owing to the stability and rigidity of habitual routines, the generation of original and divergent ideas that challenge the *status quo* is likely to be suppressed. In that case, too much team familiarity is also a barrier to team innovation.

These contrasting issues point to a solution involving balance. A moderate degree of team familiarity provides teams with a certain level of freedom to generate new ideas, and such familiarity can also help teams to implement their ideas for new solutions or products. Therefore, teams with a moderate level of familiarity are likely to have higher levels of team innovation than teams with very high or very low

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

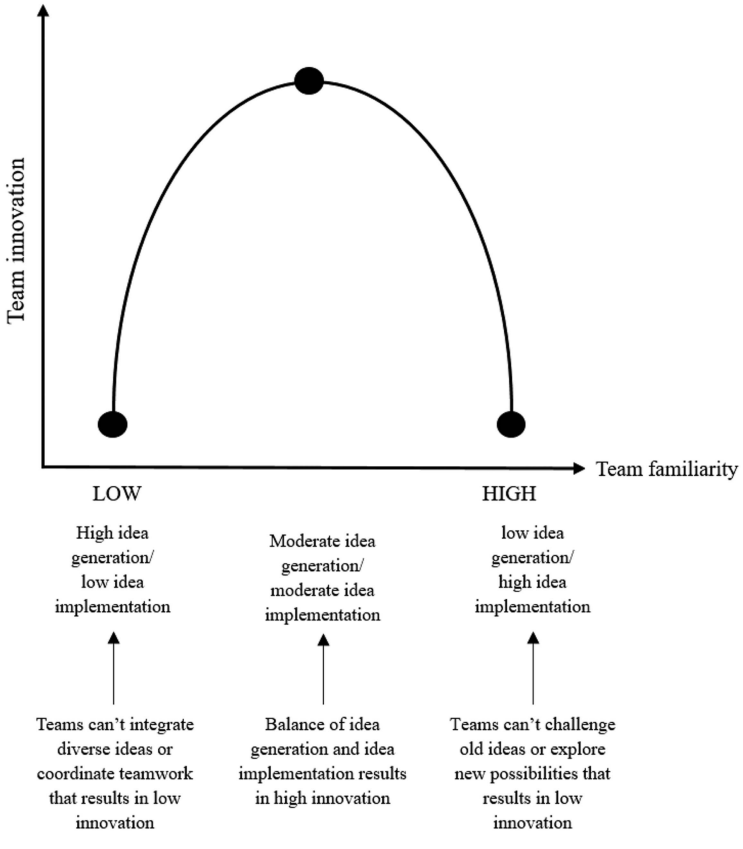


FIGURE 1. THE RELATIONSHIP BETWEEN TEAM FAMILIARITY AND TEAM INNOVATION

levels of team familiarity. Overall, our theoretical logic could be summarized in Figure 1. Specifically, we propose that teams with both high and low level of team familiarity may have low innovation. Unfamiliar teams generate too many ideas but fail to implement them. Familiar teams are likely to implement ideas well but suffer from a lack of new ideas. By contrast, teams with moderate level of team familiarity could realize the balance between idea generation and idea implementation, leading to highest innovation. Based on this reasoning, we propose following hypothesis:

Hypothesis 1: There is an inverted U-shaped relationship between team familiarity and team innovation.

The moderating effect of external learning

As proposed above, neither short-term teams nor long-standing teams can realize team innovation. To resolve this problem, managers need to find ways to weaken shackles of team familiarity with idea generation. To attenuate the negative effects of team familiarity on idea generation, teams need to overcome the constraint of rigid habitual routines when necessary. We suggest that introducing novelty provides an important stimulus for changing habitual routines (Gersick & Hackman, 1990). In most cases, such novelty is likely to arise from outside the team's boundary (Ancona, 1990; Ancona & Caldwell, 1992; Gibson & Dibble, 2013), and therefore external learning, defined as searching,

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

communicating and integrating knowledge activities with individuals outside the team, is proposed to offer an available opportunity for team members to access novel thinking (Wong, 2004).

Previous research indicates that external learning provides opportunities for teams to acquire novel information and stimulate divergent thinking (Wong, 2004), which enables the team to make adjustments to a changing context (Bresman, 2010) and change habitual routines accordingly. In accordance with these arguments, we propose that external learning is likely to moderate the inverted U-shaped relationship between team familiarity and innovation, because external learning can attenuate the negative effect of team familiarity on idea generation.

More specifically, we suggest that team familiarity is more likely to be positively related to innovation in teams that have high levels of external learning. A high level of external learning encourages teams to take notice of environmental turbulence and to embrace divergent perspectives (Wong, 2004; Bresman, 2010). Therefore, teams with high levels of external learning are more likely to become aware of the wider contexts in which they are embedded, and to make changes to habitual routines because of sorts of new information from the external (Bresman, 2010). In that case, they are less likely to develop rigid habitual routines over time, and the negative effects of team familiarity can be attenuated. Furthermore, external learning does not inevitably disrupt the development of necessary coordinated routines. Previous studies demonstrate that external learning can help teams to acquire the experience of others for improving their work routines, which in turn can enhance coordination and efficiency (e.g., Zellmer-Bruhn, 2003; Bresman, 2010). In general, the positive effect of team familiarity on idea implementation may persist, but the negative effect of team familiarity on idea generation decreases, or even disappears, if the levels of external learning are high.

In cases where external learning is low, the relationship between team familiarity and team innovation is likely to remain curvilinear, because the negative effect of team familiarity on team innovation is not sufficiently relieved. Insufficient external learning is likely to constrict divergent thinking and limit awareness of contextual changes (Wong, 2004; Gibson & Dibble, 2013). Without external interruptions, teams are inclined to grow committed to whatever routines they believe are most appropriate to their tasks (Gersick & Hackman, 1990; Zellmer-Bruhn, 2003). As these habitual routines become rigid and unshakable with the increase of team familiarity, team members grow highly dependent on those routines to process and filter diverse ideas. Any idea that is inconsistent with the current routines tends to be discarded or even resisted, and hence the process of idea generation suffers.

However, such teams can still benefit from their shared understanding and effective coordination (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000) because of habitual routines. Low levels of external learning do not necessarily impede the positive effects of team familiarity on achieving idea implementation. Therefore, we hypothesize that in the absence of external learning, the positive effects of team familiarity on idea implementation interact with the negative effects of team familiarity on idea generation, resulting in an inverted U-shaped relationship between team familiarity and team innovation. Based on the above observations, we hypothesize the following:

> Hypothesis 2: External learning moderates the inverted U-shaped relationship between team familiarity and innovation such that this relationship has an inverted U-shape for teams with low levels of external learning, but team familiarity is positively related to team innovation in teams with high levels of external learning.

METHODS

Samples and data collection

Patent data offers an ideal context for research on innovation (Lanjouw & Schankerman, 2004; Nagaoka, Motohashi, & Goto, 2010; Yoon, Lee, & Song, 2015), and information on patents is

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

commonly applied in studies of team innovation (e.g., Bain, Mann, & Pirola-Merlo, 2001; Tzabbar & Vestal, 2015). To test our hypotheses, we collected data on patents related to the electrical engineering industry from the National Bureau of Economic Research (NBER) patent database.

In the electrical engineering industry, the intensity of R&D spending is relatively high compared with other industries (Feller, Ailes, & Roessner, 2002), and R&D is generally seen as having an important influence on organizational growth and profits (Grinyer, McKiernan, & Yasai-Ardekani, 1988). Moreover, innovation is highly dependent on R&D teams in the electrical engineering industry (Leiponen, 2005). Therefore, patents filed by teams in the electrical engineering industry are highly appropriate as a focus for this study. In addition, the patent data we investigated have a long-time span, so technological revolutions may be a possible concern that influences our results. It has been suggested that the electrical technology and electronics fields have had the most stable shares of total patents over the three decades from 1965 to 1999 (Hall, Jaffe, & Trajtenberg, 2001). Therefore, the possible influence of technological revolutions is rather low in the electrical engineering industry.

All the data were collected from the NBER patent database, which includes almost three million patents granted in the United States between 1963 and 1999 (Hall, Jaffe, & Trajtenberg, 2001). Several types of information in this database are useful for this study: (1) the year when the patent was applied for and when it was granted, (2) the inventors who applied for the patent, (3) the number of citations that the patent has received (forward citation) and the number of citations that the patent has made (backward citation), (4) the pairwise citations information, and (5) the organization and the technological category that the patent belongs to. Any patent record that was not able to supply these five kinds of information was excluded from our study. Specifically, since the updated citation information is only available from 1976 to 2006, the patents that granted before 1976 were excluded.

Consistent with prior studies using patent data to research team innovation (e.g., Tzabbar & Vestal, 2015), we identify an R&D team as a group of inventors develop a given patent together. Jackson, Brett, Sessa, Cooper, Julin, and Peyronnin (1991) suggest that minimum team size for team research should be at least three members. Thus, we also excluded patents in which the number of inventors was less than three. Ultimately, our final sample consisted of 68,933 teams from 9,290 organizations, which obtained patents in the United States from 1976 through 1999. Among our samples, 43.67% of the patents ($n = 30{,}106$) were assigned to private organizations in the United States; 53.11% ($n = 36{,}610$) were assigned to private organizations outside of the United States; 2.23% ($n = 1{,}534$) were assigned to US public organizations; and 0.99% of the patents ($n = 683$) were assigned to non-US public organizations.

Measures

Team innovation

It has been suggested that the number of forward citations a patent receives (or the number of later patents that cite a given patent) is an appropriate indicator for the value and quality of innovation in a patent (e.g., Trajtenberg, 1990; Lanjouw & Schankerman, 1999; Kim, Arthurs, Sahaym, & Cullen, 2013). Following this suggestion, we measured team innovation by the number of forward citations that each patent has received. Although our sample of patents included only those granted from 1976 to 1999, we collected the number of forward citations for these patents from 1976 through 2006 by using an updated data set in the NBER database. The data on forward citations were extended because there is always a time lag between the year that a patent is granted and when it is cited by other patents. Also, the forward citation data used in our study included all citations that each patent had received across all technological categories, rather than only the citations received within the electrical engineering industry.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Team familiarity

Similar to previous studies (e.g., Huckman, Staats, & Upton, 2009; Sieweke & Zhao, 2015), we measured team familiarity by averaging the total time that each pair of team members had worked with each other. First, we identified the first year when each team member applied for a patent with a given organization (individual team tenure). This method of calculating individual team tenure for patent data was adopted from Tzabbar and Vestal (2015). Second, we determined the length of time that each pair of team members had worked together. Finally, we aggregated these dyadic measurements to the team level through averaging each pair's overlapping experience for each team, as follows (Huckman, Staats, & Upton, 2009):

$$Team\,familiarity = \sum_{i=1}^{n} \sum_{j=1}^{n} PT_{ij}/(n(n-1)/2), \quad (1)$$

where PT_{ij} refers to the length of time that team members i and j have worked together, and n refers to the team size.

External learning

We used an inverted Herfindahl index to measure external learning. To develop our measurement, we first collected backward citations (or which patents were cited by a given patent) for each patent through pairwise citation information. Next, we identified the technological categories for these backward citations by using the United States Patent and Trademark Office (USPTO) three-digit patent classification. Finally, the score of external learning for each team was quantified as follows:

$$Degree\ of\ external\ learning = 1 - \sum_{i=1}^{n} S_i^2, \quad (2)$$

where S_i refers to the proportion of citations made by a given patent that belongs to patent class i, and n the number of technological categories that a given patent has cited.

We adopted this measurement because it reflects the extent to which an R&D team integrates diverse knowledge into one patent. This measure is consistent with the notion that external learning emphasizes acquiring and integrating new knowledge from outsiders. In other words, when teams cite patents that span a wide range of technological categories, it means that they have effectively acquired and integrated a great deal of external knowledge into their work. If they only cite patents in a narrow field, it means that team members have sought and utilized external knowledge to a limited extent. A similar measurement is applied by Trajtenberg, Henderson, and Jaffe (1997), Gruber, Harhoff, and Hoisl (2013), and Kaplan and Vakili (2015) in their studies on patent data.

Control variables

Several team-level factors that may affect team innovation were controlled for in this study. First, we controlled for team size, because team size is likely to be positively related to team innovation (Hülsheger, Anderson, & Salgado, 2009). Second, we controlled for average experience, because teams that have more experience may perform better in innovation (Kaplan & Vakili, 2015). Following prior research (e.g., Kaplan & Vakili, 2015; Sieweke & Zhao, 2015), we developed a measure for the operationalization of member experience. We counted the cumulative number of patents that each inventor had applied for. Next, these cumulative numbers of patents were averaged for each team. Finally, we controlled for team member experience diversity and team tenure diversity, because previous studies suggest that diversity reflects the extent to which teams have wide-ranging knowledge or expertise for developing new ideas and products, and such diversity in turn affects team innovation (e.g., Horwitz & Horwitz, 2007; Mitchell & Boyle, 2015; Tang & Naumann, 2016). As member experience and team tenure are both continuous variables, we used the coefficient of variation to calculate team member experience diversity and team tenure diversity (Allison, 1978).

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

We also controlled for patent-level factors that may affect innovation (Tzabbar & Vestal, 2015). First, as previous research suggests that private organizations are more innovative than public organizations (e.g., Roessner, 1977; Damanpour, 1991), and as country differences are likely to affect both innovative activity (e.g., Gittelman, 2006; Varsakelis, 2006) and patent value (e.g., Bessen, 2008), we created three dummy variables to control for these ownership and country differences. Second, we controlled for the year (between 1976 and 1999) in which each patent was granted, using 23 dummy variables, as the number of citations may increase over time for each patent (Hall, Jaffe, & Trajtenberg, 2001).

RESULTS

Table 1 shows the results of descriptive statistics and pairwise correlations for each variable. Next, we used hierarchical regression analysis to test our hypotheses. To address the concern over possible multicollinearity, we mean-centered all predictors before entering them into our regression models. The highest value of variance inflation factor was 3.01 for team familiarity, which was well below the common benchmark of 10 (O'Brien, 2007). Therefore, we concluded that the problem of multicollinearity was unlikely to influence the results of our hierarchical regression analysis.

In Hypothesis 1, we proposed that the relationship between team familiarity and team innovation has an inverted U-shape. As shown in Table 2, when both team familiarity and the square of familiarity were entered in model 2, the coefficient of the squared term of team familiarity was significant in the regression ($\beta = -0.02$, $p < .01$). We further tested the inverted U-shaped relationship between team familiarity and innovation by *utest* (Lind & Mehlum, 2010). First, we tested whether the slope of both ends of curve is steep enough. In order to respond the concern that curvilinear effect may be caused by outliers (Cohen, Cohen, West, and Aiken, 2003: 413), we conducted this test with 1.5 SD below and above the mean rather than a wider data range. The same analysis has also been

Table 1. Means, standard deviation and correlates between variables

Variables	*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1 Team size	3.83	1.32	–										
2 Average member experience	7.04	8.85	0.08	–									
3 Experience diversity	0.71	0.41	0.21	0.36	–								
4 Team tenure diversity	0.85	0.70	0.14	−0.00	0.37	–							
5 Non-US private organization	0.53	0.50	0.14	0.22	0.15	0.03	–						
6 US public organization	0.02	0.15	−0.03	−0.06	−0.05	−0.02	−0.16	–					
7 Non-US public organization	0.01	0.10	−0.01	−0.05	−0.04	−0.02	−0.11	−0.02	–				
8 Team familiarity	1.20	1.92	0.07	0.48	0.03	−0.18	0.10	−0.03	−0.03	–			
9 Team familiarity squared	3.70	13.10	0.01	0.28	−0.02	−0.13	0.03	−0.00	−0.01	0.75	–		
10 External learning	0.35	0.28	0.03	0.01	0.01	−0.00	−0.12	−0.01	−0.02	0.02	0.02	–	
11 Team innovation	11.32	14.79	0.05	−0.00	0.02	0.02	−0.13	−0.03	−0.02	−0.00	−0.01	0.09	–

Note. $n = 68{,}933$; 23 dummy variables for granted year are not included.
Absolute value of correlations >0.01 is significant at $p < .01$.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

TABLE 2. THE HIERARCHICAL REGRESSION RESULTS BETWEEN TEAM FAMILIARITY AND TEAM INNOVATION

	Team innovation		
Variables	*M1*	*M2*	*M3*
Control variables			
Team size	0.76**	0.76**	0.72**
Average member experience	0.04**	0.05**	0.05**
Experience diversity	0.41*	0.36*	0.37*
Team tenure diversity	0.14	0.12	0.14
Non-US private organization	−4.79**	−4.80**	−4.52**
US public organization	−5.56**	−5.55**	−5.39**
Non-US public organization	−5.65**	−5.64**	−5.32**
Granted year	Included	Included	Included
Independent variables			
Team familiarity		0.05	0.06
Team familiarity squared		−0.02**	−0.02**
External learning			3.77**
Interactions			
Team familiarity × external learning			−0.38*
Team familiarity squared × external learning			0.05*
F	87.18**	82.20**	86.83**
R^2	0.037**	0.037**	0.042**
ΔR^2	0.037**	0.000**	0.005**

Note. $n = 68{,}933$.
*$p < .05$; **$p < .01$.

used by previous studies of curvilinear effects (e.g., Kehoe & Tzabbar, 2015; Tzabbar & Vestal, 2015). In doing so, 7.84% of our samples ($n = 5{,}401$), which were either too big or too small, were excluded from the slope test. The results indicated that the slopes of the curve at both the lower level of team familiarity (1.5 SD below the mean) ($t = 2.07$, $p < .05$) and the upper level of team familiarity (1.5 SD above the mean) ($t = -2.14$, $p < .05$) were significant. The overall result of *utest* for an inverted U shape was also significant ($t = 2.07$, $p < .05$). Furthermore, the results of *utest* showed that the inflection point of the curve was 1.14, which was about 0.6 SD above the mean ($1.14/1.92 \approx 0.6$). This finding revealed that team innovation started to decrease when team familiarity was about 0.6 SD above the mean. In addition, we graphed the relationship between team familiarity and team innovation. As shown in Figure 2, with the increase in the degree of team familiarity, team innovation first improved, and then declined, presenting an inverted U-shaped form. According to these results, Hypothesis 1 was supported.

In Hypothesis 2, we proposed that external learning may moderate the curvilinear relationship between team familiarity and team innovation. In particular, we suggested that the relationship between team familiarity and team innovation is still an inverted U-shape when external learning is low, but team familiarity is positively related to team innovation when external learning is high. As shown in Table 2 (model 3), the squared interaction term was significant in the regression ($\beta = 0.05$, $p < .05$). We graphed (see Figure 3) and further tested this moderating effect with simple slope tests, as recommended by Dawson (2014). When external learning was low (1 SD below the mean), the coefficient of the squared term for team familiarity was still significant ($\beta = -0.04$, $p < .01$). However, when external learning was high (1 SD above the mean), both the monomial term of team familiarity ($\beta = -0.05$, ns) and the squared term ($\beta = -0.01$, ns) were insignificant. Overall, Hypothesis 2 was partly supported.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

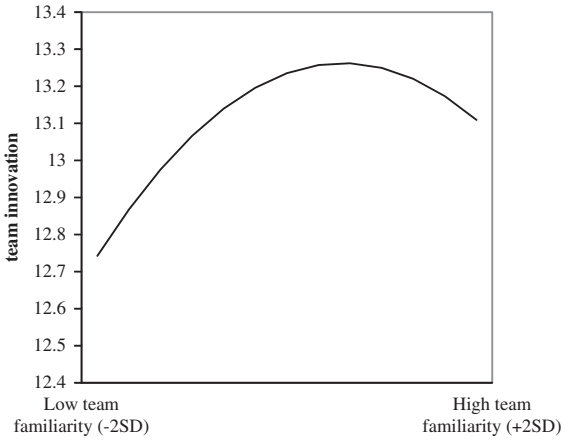


FIGURE 2. THE INVERTED U-SHAPED RELATIONSHIP BETWEEN TEAM FAMILIARITY AND TEAM INNOVATION

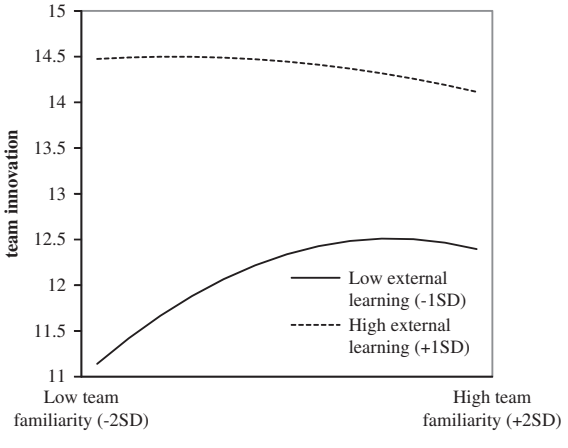


FIGURE 3. THE MODERATING EFFECT OF EXTERNAL LEARNING ON RELATIONSHIP BETWEEN TEAM FAMILIARITY AND TEAM INNOVATION

Robustness checks

Last, we conducted robustness checks using different operationalizations of team familiarity. Previous research (e.g., Berman, Down, & Hill, 2002) suggests that team familiarity may be operationalized by averaging the tenure of team members. We first determined the team tenure for each team member, and then averaged the team tenure of all the individuals to calculate team familiarity. Next, we ran a hierarchical regression analysis with the same variables that were used in models 2 and 3, but using an alternative operationalization of team familiarity. Consistent with our hypotheses, the squared term of team familiarity was still negative and significant ($\beta = -0.01$, $p < .01$) in the model testing the relationship between team familiarity and team innovation. The squared interaction term between team familiarity squared and external learning was positive and marginally significant ($\beta = 0.03$, $p < .10$) in the model for testing the moderating effect of external learning. Therefore, the results of the robustness check also supported Hypotheses 1 and 2.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

DISCUSSION

The literature is inconclusive concerning whether team familiarity benefits or hinders team innovation. Applying habitual routines theory to this problem (Gersick & Hackman, 1990), we propose that the relationship between team familiarity and team innovation may have an inverted U-shape. Furthermore, we suggest that external learning is likely to moderate this curvilinear relationship. We conducted an archival study with a data set of 68,933 R&D teams to test our hypotheses, and the results of the data analysis support most of our hypotheses. That is, our results support our proposal that the association between team familiarity and team innovation has an inverted U-shape. However, the moderation effect of external learning on this inverted U-shaped relationship is only partly supported. Our findings show that the relationship between team familiarity and innovation has an inverted U-shape when external learning is low, but neither a linear nor a curvilinear relationship is indicated when external learning is high.

One possible explanation for the nonsignificant result under high levels of external learning is that the positive effect of team familiarity on idea implementation, to some extent, may also be attenuated by external learning. Teams that are keen to seek new knowledge externally may introduce too much diversity of knowledge into the team, but teams only have limited capability to use diverse knowledge (Luan, Ling, & Xie, 2016). Therefore, it is difficult for teams to integrate diverse ideas and to develop appropriate routines when they face too much diverse information, and team coordination may suffer. As we argue that external learning is likely to attenuate the negative effect of team familiarity on idea generation, high levels of external learning is likely to simultaneously attenuate both the positive and the negative effects of team familiarity on innovation, leading to a nonsignificant relationship as our results indicated.

Theoretical contributions

Our study makes two main contributions to the relevant literature. First, this study contributes to research on the relationship between team familiarity and team innovation by reconciling paradoxical arguments and contradictory evidence. Because team familiarity can help teams to coordinate individual work (e.g., Harrison et al., 2003; Espinosa et al., 2007), identify and utilize team members' expertise (e.g., Littlepage, Robison, & Reddington, 1997; Bunderson, 2003), and develop a transactive memory system (e.g., Akgün et al., 2005), some previous studies support the argument that team familiarity is beneficial to team innovation. Other studies, however, suggest that team familiarity can hinder team innovation by attenuating internal and external communication (e.g., Katz, 1982). Such attenuated communication can cause blindness toward the need for change (e.g., Sieweke & Zhao, 2015) and induce rigidity in patterns of knowledge, thereby constraining a team from being innovative (e.g., Berman, Down, & Hill, 2002). Through an inquiry based on habitual routines theory, our study is conducive to reconciling these contradictions. We find that the relationship between team familiarity and team innovation is indeed curvilinear. When team familiarity is low, teams are prohibited by a lack of mature implementation routines from high quality of team innovation. However, as team familiarity becomes too high, the generation of creative ideas significantly drops and team innovation suffers consequently. Only the moderate level of team familiarity produces the best team innovation because both idea generation and idea implementation are assured.

Moreover, by proposing and testing our hypothesis regarding a curvilinear relationship between team familiarity and team innovation, our study also responds to an important question from Anderson, Potočnik, and Zhou (2014). These researchers propose research to assess whether increasing a variable that has been found positively associated with innovation at a glance will always elevate the level of innovation. By proposing and examining a nonlinear relation between team familiarity and innovation, our study finds the potential negative impact of team familiarity on innovation when team

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

familiarity goes too far. Therefore, our findings support their arguments. There could be more antecedents of team innovation covered by previous studies, just like team familiarity in our study, which need further attention to their influence on team innovation based on Anderson et al.'s (2014) suggestion.

Second, we contribute to the literature on habitual routines theory by highlighting the potential effect of external learning for impacting habitual routines. Gersick and Hackman (1990) suggested that encountering novel situations provided an important impetus for teams to modify or break their habitual routines. However, many researchers argue that teams with high levels of familiarity are usually unable to adapt in changing situations and to become unproductive over time (e.g., Katz, 1982; Berman, Down, & Hill, 2002). In other words, teams that have high levels of familiarity may be increasingly unaware of novelty in their changing environment. Our study proposes that external learning is conducive to providing an opportunity for teams to perceive novel stimulus and to embrace new perspectives. In line with this, we found that external learning could partly attenuate the negative effect of too much team familiarity on team innovation. Although the nonlinear relationship between team familiarity and team innovation is still significant under a low level of external learning, the negative influence of intense team familiarity on team innovation is buffered by a high level of team external learning. Teams are endowed with access to external knowledge and ideas by a high level of external learning. They are thus more likely to notice external change and novelty, and then have materials to propose new ideas.

It merits noticing that we did not find a positively linear relationship between team familiarity and team innovation under the high level of external learning. Previous studies argued that excessive external activities might interfere with team internal cooperation (e.g., Gibson & Dibble, 2013), which could explain the nonsignificant results under high levels external learning. Despite its positive influence on idea generation, we speculate that the presence of high levels of external learning probably makes the team difficult to develop and set down routines for idea implementation. We suggest that further research retests the moderating effects of external learning by uncovering the underlying mechanism between team familiarity and team innovation.

Practical implications

Our study also has several important implications for practice. First, we provide an insight on how to deal with team familiarity in team design. On the one hand, in many organizations, innovative tasks are conducted by project-based teams, which will be disbanded after the project is completed. Whereas organizations can select specific employees based on the task requirements, team instability and its temporary membership may cause coordination problems and in turn stifle innovation (Edmondson & Nembhard, 2009). Members of newly established teams require time to be familiar with each other, which is conducive to the formation of shared cognitive structure (Akgün & Lynn, 2002; Akgün et al., 2005) and uncertainty reduction about interpersonal interaction (Littlepage, Robison, & Reddington, 1997). Therefore, for organizations that are accustomed to utilize disposable teams, they need to wait patiently until team members become familiar with each other, otherwise team innovation will suffer owing to lack of shared understanding of both task-related and relationship-related issues.

On the other hand, our findings alert managers to the possible danger of 'too much of a good thing effect' (Pierce & Aguinis, 2013) for team familiarity. We show that team familiarity does not always lead to desirable outcomes, and excessive familiarity may result in a decline of innovation. When employees have been working together for a long time, they are apt to be slaves of habitual routines. Too much familiarity leads to homogeneity in thinking (Katz, 1982; Choi & Thompson, 2005) and intense commitment to prior experiences and routines (Gersick & Hackman, 1990), thereby stifling alternative perspectives and new ideas. As idea generation is highly dependent on diverse knowledge

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

and novel ideas (Zhou & Hoever, 2014), long-standing teams are stuck in habitual routines and prevent themselves from innovation. For example, through a study of innovation teams in 12 global companies, Ashkenas and Spiegel (2015) found the teams that are used to blindly follow habitual routines or norms are often unsuccessful in innovation.

In sum, because neither short-term teams nor long-standing teams enable innovation, organizations need to consider carefully how to build a team and when to dissolve the team. It is better that organizations can select members with a moderate level of familiarity. Once a team has been united for a long time, organizations should be cautious about its motivation or capability to innovate. It is noted that we do not suggest the teams whose members are familiar with each other must be dissolved. We found that external learning could partly attenuate the negative influence of team familiarity on innovation. Therefore, it may be a possible solution to encourage teams, especially long-standing teams, to span team boundaries and to learn from the outside. Based on relevant research, we provide several suggestions for management on how to stimulate external learning. First, it is suggested that psychological safety plays a critical role in external learning (Bresman & Zellmer-Bruhn, 2013). According to this, leaders should encourage and support team members to express alternative ideas and engage in the trail-and-error process (Nembhard & Edmondson, 2006). Second, individuals are motivated to engage in external activities when these activities become a part of their personal roles (Marrone, Tesluk, & Carson, 2007). Therefore, managers can promote external learning through assigning responsibilities of external activities to team members. Meanwhile, because the positively linear association between team familiarity and team innovation under the high level of external learning was not supported by the results, we recommended team leaders to keep their eyes skinned for the influence of external learning especially on intrateam coordination. As previous literature suggests (e.g., Wong, 2004), it is important to keep the balance between external learning activities and internal coordination activities, whereas excessive external activities may result in the loss of coordination within team.

Limitations and future research

This study also has several limitations. First, because of the study's cross-sectional design, we were not able to make any causal claims for our results. Experimental study is required to test the causal relationships involved in our theories.

Second, we measured team familiarity by using an objective index (i.e., tenure) rather than by self-report scales. This approach may have limited our ability to make a more detailed investigation into the effects of team familiarity on team innovation. For example, individuals are likely to gradually become familiar with both their tasks (task familiarity) and their coworkers (group familiarity) over time (e.g., Littlepage, Robison, & Reddington, 1997; Espinosa et al., 2007). However, the measures used in our study could not distinguish between these two types of familiarity. Therefore, it should be interesting in future studies to investigate whether task familiarity and group familiarity may have different effects on team innovation.

Third, although we proposed that the generation and implementation of creative ideas could mediate the effect of team familiarity on team innovation, we could not examine these two variables separately due to the limits of our data set. We encourage future studies to reexamine our theoretical model by directly measuring these two mechanisms.

Finally, although most of hypotheses are supported, the effect size of our findings is small. It might be because curvilinear effects are commonly smaller than main effects of a linear relationship (Busse, Mahlendorf, & Bode, 2016). Another possible explanation is that sample size is usually inversely related to effect size (Mcmahon, Holly, Harrington, Roberts, & Green, 2008). The sample size of this study is rather large ($n = 68{,}933$), therefore the effect size of our findings could be small compared with

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

other studies using a small sample. Nevertheless, we still strongly recommend future studies to retest what we have found in this study and to pay more attention to understand the relationship between team familiarity and team innovation.

CONCLUSION

Whether team familiarity may benefit or harm team innovation is inconclusive in current literature. We address this question by an archival study with a big sample of 68,933 R&D teams. The results show that the relationship between team familiarity and innovation is inverted U-shaped, and external learning could moderate this relationship. In so doing, our study is helpful to reconcile the paradoxical arguments and empirical evidences in previous research. The curvilinear relationship indicates that moderate level of familiarity produces best team innovation, and therefore those teams that are primarily responsible for innovative task are optimal to keep a certain level of stability in team membership or shared experiences of working together. Moreover, we contribute to habitual routines theory by highlighting the impact of external learning on breaking out rigid routines. Managers should bear in mind that external learning could partly attenuate the negative effect of too much team familiarity on team innovation.

ACKNOWLEDGEMENTS

This research is supported by the National Natural Science Foundation of China (Project No. 71772159 and No. 71372056) and the Fundamental Research Funds for the Central Universities.

References

Akgün, A. E., Byrne, J., Keskin, H., Lynn, G. S., & Imamoglu, S. Z. (2005). Knowledge networks in new product development projects: A transactive memory perspective. *Information & Management*, *42*(8), 1105–1120. https://doi.org/10.1016/j.im.2005.01.001.

Akgün, A. E., & Lynn, G. S. (2002). Antecedents and consequences of team stability on new product development performance. *Journal of Engineering and Technology Management*, *19*(3), 263–286. https://doi.org/10.1016/S0923-4748(02)00021-8.

Allison, P. D. (1978). Measures of inequality. *American Sociological Review*, *43*(6), 865–880. https://doi.org/10.2307/2094626.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, *39*(5), 1154–1184. https://doi.org/10.2307/256995.

Ancona, D. G. (1990). Outward bound: Strategies for team survival in an organization. *Academy of Management Journal*, *33*(2), 334–365. https://doi.org/10.2307/256328.

Ancona, D. G., & Caldwell, D. F. (1992). Bridging the boundary: External activity and performance in organizational teams. *Administrative Science Quarterly*, *37*(4), 634–665. https://doi.org/10.2307/2393475.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*(5), 1297–1333. https://doi.org/10.1177/0149206314527128.

Ashkenas, R., & Spiegel, M. (2015). Your innovation team shouldn't run like a Well-Oiled machine. *Harvard Business Review*, 2–5. Retrieved December 20, 2016, from https://hbr.org/2015/10/your-innovation-team-shouldnt-run-like-a-well-oiled-machine.

Bain, P. G., Mann, L., & Pirola-Merlo, A. (2001). The innovation imperative: The relationships between team climate, innovation, and performance in research and development teams. *Small Group Research*, *32*(1), 55–73. https://doi.org/10.1177/104649640103200103.

Berman, S. L., Down, J., & Hill, C. W. L. (2002). Tacit knowledge as a source of competitive advantage in the national basketball association. *Academy of Management Journal*, *45*(1), 13–31. https://doi.org/10.2307/3069282.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Bessen, J. (2008). The value of U.S. patents by owner and patent characteristics. *Research Policy*, *37*(5), 932–945. https://doi.org/10.1016/j.respol.2008.02.005.

Bledow, R., Frese, M., Anderson, N., Erez, M., & Farr, J. (2009). A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity. *Industrial & Organizational Psychology*, *2*(3), 305–337. https://doi.org/10.1111/j.1754-9434.2009.01154.x.

Bresman, H. (2010). External learning activities and team performance: A multimethod field study. *Organization Science*, *21*(1), 81–96. https://doi.org/10.1287/orsc.1080.0413.

Bresman, H., & Zellmer-Bruhn, M. (2013). The structural context of team learning: Effects of organizational and team structure on internal and external learning. *Organization Science*, *24*(4), 1120–1139. https://doi.org/10.1287/orsc.1120.0783.

Bunderson, J. S. (2003). Recognizing and utilizing expertise in work groups: A status characteristics perspective. *Administrative Science Quarterly*, *48*(4), 557–591. https://doi.org/10.2307/3556637.

Busse, C., Mahlendorf, M. D., & Bode, C. (2016). The ABC for studying the too-much-of-a-good-thing effect: A competitive mediation framework linking antecedents, benefits, and costs. *Organizational Research Methods*, *19*(1), 131–153. https://doi.org/10.1177/1094428115579699.

Chi, N. W., Huang, Y. M., & Lin, S. C. (2009). A double-edged sword? Exploring the curvilinear relationship between organizational tenure diversity and team innovation: The moderating role of team-oriented HR practices. *Group & Organization Management*, *34*(6), 698–726. https://doi.org/10.1177/1059601109350985.

Choi, H. S., & Thompson, L. (2005). Old wine in a new bottle: Impact of membership change on group creativity. *Organizational Behavior and Human Decision Processes*, *98*(2), 121–132. https://doi.org/10.1016/j.obhdp.2005.06.003.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. Mahwah, NJ: Lawrence Erlbaum.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, *34*(3), 555–590. https://doi.org/10.2307/256406.

Dawson, J. F. (2014). Moderation in management research: What, why, when, and how. *Journal of Business and Psychology*, *29*(1), 1–19. https://doi.org/10.1007/s10869-013-9308-7.

Edmondson, A. C., & Nembhard, I. M. (2009). Product development and learning in project teams: The challenges are the benefits. *Journal of Product Innovation Management*, *26*(2), 123–138. https://doi.org/10.1111/j.1540-5885.2009.00341.x.

Espinosa, J. A., Slaughter, S. A., Kraut, R. E., & Herbsleb, J. D. (2007). Familiarity, complexity, and team performance in geographically distributed software development. *Organization Science*, *18*(4), 613–630. https://doi.org/10.1287/orsc.1070.0297.

Feldman, M. S., & Rafaeli, A. (2002). Organizational routines as sources of connections and understandings. *Journal of Management Studies*, *39*(3), 309–331. https://doi.org/10.1111/1467-6486.00294.

Feller, I., Ailes, C. P., & Roessner, J. D. (2002). Impacts of research universities on technological innovation in industry: Evidence from engineering research centers. *Research Policy*, *31*(3), 457–474. https://doi.org/10.1016/S0048-7333(01)00119-6.

Gajendran, R. S., & Joshi, A. (2012). Innovation in globally distributed teams: The role of LMX, communication frequency, and member influence on team decisions. *Journal of Applied Psychology*, *97*(6), 1252–1261. https://doi.org/10.1037/a0028958.

Gebert, D., Boerner, S., & Kearney, E. (2010). Fostering team innovation: Why is it important to combine opposing action strategies? *Organization Science*, *21*(3), 593–608. https://doi.org/10.1287/orsc.1090.0485.

Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task-performing groups. *Organizational Behavior and Human Decision Processes*, *47*(1), 65–97. https://doi.org/10.1016/0749-5978(90)90047-D.

Gevers, J. M., Rispens, S., & Li, J. (2016). Pacing style diversity and team collaboration: The moderating effects of temporal familiarity and action planning. *Group Dynamics: Theory, Research, and Practice*, *20*(2), 78–92. https://doi.org/10.1037/gdn0000049.

Gibson, C. B., & Dibble, R. (2013). Excess may do harm: Investigating the effect of team external environment on external activities in teams. *Organization Science*, *24*(3), 697–715. https://doi.org/10.1287/orsc.1120.0766.

Gittelman, M. (2006). National institutions, public-private knowledge flows, and innovation performance: A comparative study of the biotechnology industry in the US and France. *Research Policy*, *35*(7), 1052–1068. https://doi.org/10.1016/j.respol.2006.05.005.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Glynn, M. A. (1996). Innovative genius: A framework for relating individual and organizational intelligences to innovation. *Academy of Management Review*, *21*(4), 1081–1111. https://doi.org/10.2307/259165.

Goodman, P. S., & Leyden, D. P. (1991). Familiarity and group productivity. *Journal of Applied Psychology*, *76*(4), 578–586. https://doi.org/10.1037/0021-9010.76.4.578.

Grinyer, P. H., McKiernan, P., & Yasai-Ardekani, M. (1988). Market, organizational and managerial correlates of economic performance in the U.K. electrical engineering industry. *Strategic Management Journal*, *9*(4), 297–318. https://doi.org/10.1002/smj.4250090402.

Gruber, M., Harhoff, D., & Hoisl, K. (2013). Knowledge recombination across technological boundaries: Scientists vs. engineers. *Management Science*, *59*(4), 837–851. https://doi.org/10.1287/mnsc.1120.1572.

Hall, B. H., Jaffe, A. B., & Trajtenberg, M. (2001). *The NBER patent citations data file: Lessons, insights and methodological tools* (National Bureau of Economic Research Working Paper No. 8498). National Bureau of Economic Research, Cambridge, MA.

Harrison, D. A., Mohammed, S., Mcgrath, J. E., Florey, A. T., & Vanderstoep, S. W. (2003). Time matters in team performance: Effects of member familiarity, entrainment, and task discontinuity on speed and quality. *Personnel Psychology*, *56*(3), 633–669. https://doi.org/10.1111/j.1744-6570.2003.tb00753.x.

Horwitz, S. K., & Horwitz, I. B. (2007). The effects of team diversity on team outcomes: A meta-analytic review of team demography. *Journal of Management*, *33*(6), 987–1015. https://doi.org/10.1177/0149206307308587.

Hu, L., & Randel, A. E. (2014). Knowledge sharing in teams: Social capital, extrinsic incentives, and team innovation. *Group & Organization Management*, *39*(2), 213–243. https://doi.org/10.1177/1059601114520969.

Huckman, R. S., & Staats, B. R. (2011). Fluid tasks and fluid teams: The impact of diversity in experience and team familiarity on team performance. *Manufacturing & Service Operations Management*, *13*(3), 310–328. https://doi.org/10.1287/msom.1100.0321.

Huckman, R. S., Staats, B. R., & Upton, D. M. (2009). Team familiarity, role experience, and performance: Evidence from Indian software services. *Management Science*, *55*(1), 85–100. https://doi.org/10.1287/mnsc.1080.0921.

Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology*, *94*(5), 1128–1145. https://doi.org/10.1037/a0015978.

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions, and turnover. *Journal of Applied Psychology*, *76*(5), 675–689. https://doi.org/10.1037/0021-9010.76.5.675.

Jones, R. G., & George, M. J. (Eds.) (2014). *Essentials of contemporary management* (6th ed.), New York, NY: McGraw-Hill.

Kaplan, S., & Vakili, K. (2015). The double-edged sword of recombination in breakthrough innovation. *Strategic Management Journal*, *36*(10), 1435–1457. https://doi.org/10.1002/smj.2294.

Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative Science Quarterly*, *27*(1), 81–104. https://doi.org/10.2307/2392547.

Kehoe, R. R., & Tzabbar, D. (2015). Lighting the way or stealing the shine? An examination of the duality in star scientists' effects on firm innovative performance. *Strategic Management Journal*, *36*(5), 709–727. https://doi.org/10.1002/smj.2240.

Kim, S. K., Arthurs, J. D., Sahaym, A., & Cullen, J. B. (2013). Search behavior of the diversified firm: The impact of fit on innovation. *Strategic Management Journal*, *34*(8), 999–1009. https://doi.org/10.1002/smj.2038.

Lanjouw, J. O., & Schankerman, M. (1999). *The quality of ideas: Measuring innovation with multiple indicators* (National Bureau of Economic Research Working Paper No. 7345). National Bureau of Economic Research, Cambridge, MA.

Lanjouw, J. O., & Schankerman, M. (2004). Patent quality and research productivity: Measuring innovation with multiple indicators. *The Economic Journal*, *114*(495), 441–465. https://doi.org/10.1111/j.1468-0297.2004.00216.x.

Leiponen, A. (2005). Organization of knowledge and innovation: The case of Finnish business services. *Industry and Innovation*, *12*(2), 185–203. https://doi.org/10.1080/13662710500087925.

Lind, J. T., & Mehlum, H. (2010). With or without U: The appropriate test for a U-shaped relationship. *Oxford Bulletin of Economics & Statistics*, *72*(1), 109–118. https://doi.org/10.1111/j.1468-0084.2009.00569.x.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Littlepage, G., Robison, W., & Reddington, K. (1997). Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organizational Behavior and Human Decision Processes*, *69*(2), 133–147. https://doi.org/10.1006/obhd.1997.2677.

Liu, J., Chen, J., & Tao, Y. (2015). Innovation performance in new product development teams in china's technology ventures: The role of behavioral integration dimensions and collective efficacy. *Journal of Product Innovation Management*, *32*(1), 29–44. https://doi.org/10.1111/jpim.12177.

Luan, K., Ling, C.-D., & Xie, X.-Y. (2016). The nonlinear effects of educational diversity on team creativity. *Asia Pacific Journal of Human Resources*, *54*(4), 465–480. https://doi.org/10.1111/1744-7941.12078.

Marrone, J. A., Tesluk, P. E., & Carson, J. B. (2007). A multilevel investigation of antecedents and consequences of team member boundary-spanning behavior. *Academy of Management Journal*, *50*(6), 1423–1439. https://doi.org/10.5465/AMJ.2007.28225967.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology*, *85*(2), 273–283. https://doi.org/10.1037/0021-9010.85.2.273.

Mcmahon, B., Holly, L., Harrington, R., Roberts, C., & Green, J. (2008). Do larger studies find smaller effects? The example of studies for the prevention of conduct disorder. *European Child & Adolescent Psychiatry*, *17*(7), 432–437. https://doi.org/10.1007/s00787-008-0685-9.

Mitchell, R., & Boyle, B. (2015). Professional diversity, identity salience and team innovation: The moderating role of openmindedness norms. *Journal of Organizational Behavior*, *36*(6), 873–894. https://doi.org/10.1002/job.2009.

Nagaoka, S., Motohashi, K., & Goto, A. (2010). Chapter 25: Patent statistics as an innovation indicator. In H. H. Bronwyn & N. Rosenberg (Eds.), *Handbook of the economics of innovation* (Vol. 2, pp. 1083–1127). Amsterdam: Elsevier Science.

Nembhard, I. M., & Edmondson, A. C. (2006). Making it safe: The effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *Journal of Organizational Behavior*, *27*(7), 941–966. https://doi.org/10.1002/job.413.

Nemeth, C. J., & Ormiston, M. (2007). Creative idea generation: Harmony versus stimulation. *European Journal of Social Psychology*, *37*(3), 524–535. https://doi.org/10.1002/ejsp.373.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*(5), 673–690. https://doi.org/10.1007/s11135-006-9018-6.

Pierce, J. R., & Aguinis, H. (2013). The too-much-of-a-good-thing effect in management. *Journal of Management*, *39*(2), 313–338. https://doi.org/10.1177/0149206311410060.

Post, C. (2012). Deep-level team composition and innovation: The mediating roles of psychological safety and cooperative learning. *Group & Organization Management*, *37*(5), 555–588. https://doi.org/10.1177/1059601112456289.

Reagans, R., Argote, L., & Brooks, D. (2005). Individual experience and experience working together: Predicting learning rates from knowing who knows what and knowing how to work together. *Management Science*, *51*(6), 869–881. https://doi.org/10.1287/mnsc.1050.0366.

Roessner, J. D. (1977). Incentives to innovate in public and private organizations. *Administration & Society*, *9*(3), 341–365. https://doi.org/10.1177/009539977700900304.

Rosing, K., Frese, M., & Bausch, A. (2011). Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership. *The Leadership Quarterly*, *22*(5), 956–974. https://doi.org/10.1016/j.leaqua.2011.07.014.

Savelsbergh, C. M., Poell, R. F., & van der Heijden, B. I. (2015). Does team stability mediate the relationship between leadership and team learning? An empirical study among Dutch project teams. *International Journal of Project Management*, *33*(2), 406–418. https://doi.org/10.1016/j.ijproman.2014.08.008.

Sheremata, W. A. (2000). Centrifugal and centripetal forces in radical new product development under time pressure. *Academy of Management Review*, *25*(2), 389–408. https://doi.org/10.5465/amr.2000.3312925.

Sieweke, J., & Zhao, B. (2015). The impact of team familiarity and team leader experience on team coordination errors: A panel analysis of professional basketball teams. *Journal of Organizational Behavior*, *36*(3), 382–402. https://doi.org/10.1002/job.1993.

Slotegraaf, R. J., & Atuahene-Gima, K. (2011). Product development team stability and new product advantage: The role of decision-making processes. *Journal of Marketing*, *75*(1), 96–108. https://doi.org/10.1509/jmkg.75.1.96.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press

Tang, C., & Naumann, S. E. (2016). Team diversity, mood, and team creativity: The role of team knowledge sharing in Chinese R & D teams. *Journal of Management & Organization*, *22*(3), 420–434. https://doi.org/10.1017/jmo.2015.43.

Taylor, A., & Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal*, *49*(4), 723–740. https://doi.org/10.5465/AMJ.2006.22083029.

Trajtenberg, M. (1990). A penny for your quotes: Patent citations and the value of innovations. *The RAND Journal of Economics*, *21*(1), 172–187. https://doi.org/10.2307/2555502.

Trajtenberg, M., Henderson, R., & Jaffe, A. (1997). University versus corporate patents: A window on the basicness of invention. *Economics of Innovation and New Technology*, *5*(1), 19–50. https://doi.org/10.1080/10438599700000006.

Tzabbar, D., & Vestal, A. (2015). Bridging the social chasm in geographically distributed R&D teams: The moderating effects of relational strength and status asymmetry on the novelty of team innovation. *Organization Science*, *26*(3), 811–829. https://doi.org/10.1287/orsc.2015.0969.

Varsakelis, N. C. (2006). Education, political institutions and innovative activity: A cross-country empirical investigation. *Research Policy*, *35*(7), 1083–1090. https://doi.org/10.1016/j.respol.2006.06.002.

Wong, S. S. (2004). Distal and local group learning: Performance trade-offs and tensions. *Organization Science*, *15*(6), 645–656. https://doi.org/10.1287/orsc.1040.0080.

Yoon, W., Lee, D. Y., & Song, J. (2015). Alliance network size, partner diversity, and knowledge creation in small biotech firms. *Journal of Management & Organization*, *21*(5), 614–626. https://doi.org/https://doi.org/10.1017/jmo.2015.16.

Zellmer-Bruhn, M. E. (2003). Interruptive events and team knowledge acquisition. *Management Science*, *49*(4), 514–528. https://doi.org/10.1287/mnsc.49.4.514.14423.

Zhou, J., & Hoever, I. J. (2014). Research on workplace creativity: A review and redirection. *Annual Review of Organizational Psychology and Organizational Behavior*, *1*(1), 333–359. https://doi.org/10.1146/annurev-orgpsych-031413-091226.

Ziller, R. C., Behringer, R. D., & Goodchilds, J. D. (1962). Group creativity under conditions of success or failure and variations in group stability. *Journal of Applied Psychology*, *46*(1), 43–49. https://doi.org/10.1146/10.1037/h0045647.

https://doi.org/10.1017/jmo.2017.85 Published online by Cambridge University Press