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Research Article

Understanding employee innovative behavior: Integrating the social network and leader–member exchange perspectives†

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Summary By integrating social network theory and leader–member exchange (LMX) theory, we explore the effects of three types of social relationships on employee innovative behavior: weak ties outside the group, LMX, and strong ties within the group. The results from a sample in a high-tech firm showed that LMX fully mediated the positive relationship between out-group weak ties and innovative behavior. Furthermore, within-group strong ties negatively moderated the second stage of this indirect relationship, such that LMX was positively and significantly related to innovative behavior only when the number of within-group strong ties was low. The theoretical and practical implications of these findings are discussed. Copyright © 2015 John Wiley & Sons, Ltd.

Keywords: innovative behavior; social network; leader–member exchange

Introduction

Innovative behavior is defined as the "intentional generation, promotion, and realization of new ideas within a work role, workgroup, or organization" (Janssen & Van Yperen, 2004, p. 370). It has become a common measure of employee performance, particularly in fast-growing industries. The success of individual innovation largely depends on an employee's network of relationships within the organization, because it is these relationships that provide the requisite inspiration, information, resources, and support that help innovators develop, promote, and realize their new ideas (Granovetter, 1973; Kanter, 1988; Krackhardt, 1992; Lin, 2001; Perry-Smith & Shalley, 2003).

Employees are simultaneously embedded in their workgroups and their organization, so their relationships in the organization can be divided into connections within versus outside the workgroup. Prior research has outlined the importance of outside connections in facilitating innovation (Hülsheger, Anderson, & Salgado, 2009). According to the strength-of-weak-tie theory (Granovetter, 1973), the benefits of outside connections are optimized by *weak ties*, defined as the social relationships that feature relatively infrequent interactions and comparably low levels of emotional closeness. Outside weak ties can provoke novel ideas because they provide access to a wider array of people in diverse social circles and thought worlds (Perry-Smith & Shalley, 2003). There is accumulating evidence that demonstrates the positive effect of outside weak ties on innovation (Baer, 2010; Perry-Smith, 2006; Zhou, Shin, Brass, Choi, & Zhang, 2009). However, there are several gaps in this line of research.

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First, few of the studies linking weak ties with innovation have considered possible explanatory mediating mechanisms. Drawing on weak-tie theory (Granovetter, 1973), Perry-Smith and Shalley (2003) emphasize the informational benefits of weak ties. That is, weak ties enhance creativity (or the generation of new ideas) by bringing in nonredundant information and diverse perspectives. However, empirical tests of this proposition are scarce, and the evidence is inconclusive (M. H. Anderson, 2008; Perry-Smith, 2006). Furthermore, innovation is not just about generating ideas, it is also an interactional process of refining, promoting, and implementing ideas (Baer, 2012; Kanter, 1988; Van de Ven, 1986). After generating a creative idea, the innovator also needs to seek feedback to refine the idea, mobilize support and sponsorship for the idea from significant others (i.e., idea promotion), and translate the idea into tangible solutions or products (i.e., idea implementation; Kanter, 1988; S. G. Scott & Bruce, 1994). Because weak ties are distant and loose, they are less likely to provide timely feedback, direct support, and advocacy, all of which are necessary for the success of individual innovation. By integrating the relevant tenets of strength-of-weak-tie theory (Granovetter, 1973) and leader–member exchange (LMX) theory (Graen & Uhl-Bien, 1995), we argue that LMX may be an important mechanism through which outside weak ties impact innovative behavior. That is, a well-connected employee can leverage valuable information and advice gained from out-group weak ties to develop a high-quality LMX, which in turn will facilitate the employee's innovative behavior (S. G. Scott & Bruce, 1994).

Second, besides the relationship with the group leader, an employee also develops and maintains relationships with a range of peers within the workgroup. Although LMX (S. G. Scott & Bruce, 1994; Tierney, Farmer, & Graen, 1999) and peer ties (Baer, 2012; Krackhardt, 1992) have been separately linked to innovation, it is still not clear how these two types of internal relationships *interact to* influence innovation. In order to fill this gap, we examine the moderation effect of within-group strong ties in the relation between LMX and innovation. *Within-group strong tie* is defined as a peer relationship that involves frequent interactions and high levels of emotional intensity (Krackhardt, 1992). We argue that within-group strong ties will *substitute* the importance of LMX for innovation, such that the positive relationship between LMX and innovation is stronger when the number of within-group strong ties is relatively low. And LMX becomes less important for the success of innovation when an employee has many within-group strong ties.

In sum, we propose a moderated mediation model that unfolds why, how, and when out-group weak ties are related to employees' innovative behavior. Specifically, out-group weak ties are assumed to have an indirect relationship with innovative behavior through the explanatory intervening mechanism of LMX. Moreover, this indirect relationship is assumed to be conditional on the moderator variable of within-group strong ties for the path from LMX to innovative behavior. Our conceptual model is depicted in Figure 1.

This study contributes to the social network, innovation, and social exchange literatures in the following ways. First, we aim to extend the strength-of-weak-tie theory (Granovetter, 1973) by revealing the instrumental value of out-group weak ties in improving the individual employee's social exchange relationship with the leader. That is, outside weak ties can put the individual in an advantageous position in the social exchange with the leader and help him or her develop a high-quality LMX.

Second, we contribute to the innovation literature by investigating the mediation role of LMX in the linkage between out-group weak ties and innovative behavior. The social network approach and the LMX perspective have

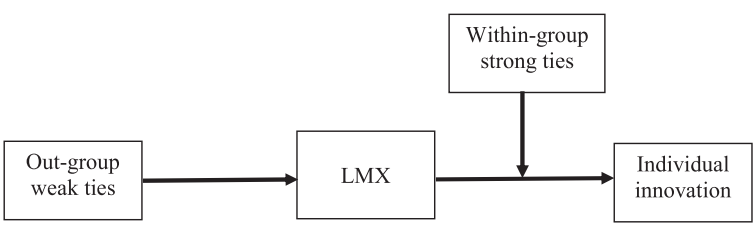

Figure 1. Conceptual model. LMX, leader–member exchange

DOI: 10.1002/job

been separately examined in relation to innovation. However, no studies, to our knowledge, have examined how these two types of relationships relate to one another in their effects on innovative behavior. Our study explores the extent to which out-group weak ties provoke innovative behavior by enhancing the quality of LMX. In doing so, we attempt to open the "black box" in the relationship between out-group networks and innovative behavior.

Third, we contribute to social exchange theory by revealing how different exchange relationships within the work unit jointly influence employee innovative behavior. Social exchange theory (Blau, 1964; Cropanzano & Mitchell, 2005) provides a general guideline describing how relationships in the workplace evolve over time, but the theory does not specify how different types of relationships combine and interact in their influence on employee work outcomes (Cole, Schaninger, & Harris, 2002). Thus, it is not clear whether one type of exchange relationship will strengthen or substitute for the effect of the other. This study tests a substituting hypothesis and explores the importance of within-group strong ties in facilitating innovation when high-quality LMX is absent.

To summarize, drawing on weak-tie theory (Granovetter, 1973; Perry-Smith, 2006), LMX theory (Graen & Uhl-Bien, 1995), and social exchange theory (Blau, 1964; Cole et al., 2002), we propose a fine-grained model that illustrates how three different, yet related, types of interpersonal relations (i.e., outside-group weak ties, LMX, and within-group strong ties) jointly influence employees' innovative behavior. As such, we attempt to advance our understanding of how employees leverage their whole networks within the organization to achieve innovation.

Theory and Hypothesis Development

Defining innovative behavior

Following previous studies (Kanter, 1988; S. G. Scott & Bruce, 1994), we define *innovative behavior* as complex behavior consisting of three different tasks: idea generation, idea promotion, and idea realization. Individual innovation starts with *idea generation*, or the production of new ideas or solutions, which can be either original or adapted from existing products or processes (Kanter, 1988; Woodman, Sawyer, & Griffin, 1993). The next step of the innovation process is *idea promotion*. An innovative individual must engage in social activities in order to gain stakeholder approval and sponsorship of new ideas and to build a coalition of backers and supporters who will help the innovator sell the idea to potential allies (Kanter, 1988). The third task is *idea realization*. The innovator must implement the creative idea and transform it into tangible products and processes that can enhance the profitability and efficiency of the individual, group, or organization (Kanter, 1988; S. G. Scott & Bruce, 1994).

Therefore, innovation encompasses a wider range of actions than creativity. Whereas creativity refers exclusively to idea generation (Mumford & Gustafson, 1988), innovation covers broader aspects, including idea generation, promotion, and realization (Kanter, 1988; S. G. Scott & Bruce, 1994; Van de Ven, 1986). As a result, creativity is recognized as a starting point of the multistage innovation process (Janssen, 2000; Kanter, 1988; Van der Vegt & Janssen, 2003). Innovation is a set of discontinuous activities, rather than discrete, sequential stages (Schroeder, Van de Ven, Scudder, & Polley, 1989). Innovation can occur in any combination of these activities at any one time (S. G. Scott & Bruce, 1994).

Outside weak ties and employee innovative behavior

An individual's social network in the organization can be divided into social ties outside versus within his or her work unit. Perry-Smith and Shalley (2003) contend that weak ties with people outside one's own group are crucial for innovation. Out-group weak ties involve infrequent interactions and comparatively low emotional closeness. Thus, they are more efficient in connecting the focal individual to a wide range of social circles and thought worlds (Granovetter, 1973; Perry-Smith, 2006). Repeated evidence has shown the positive effect of outside weak ties on

DOI: 10.1002/job

creativity or innovation (Baer, 2010; Hülsheger et al., 2009; Perry-Smith, 2006; Zhou et al., 2009). However, very few empirical studies have examined the mechanisms through which outside weak ties contribute to innovation.

The key premise of weak-tie theory is that weak ties enhance innovation by providing different pockets of nonredundant information and diverse perspectives (Granovetter, 1973; Perry-Smith & Shalley, 2003). However, prior studies have not provided conclusive support for this argument. Anderson (2008) found that larger networks can provide managers with more task-relevant and diverse information, but this study did not include any innovative outcomes, so it is not clear whether such diverse information can actually enhance innovation. Using a sample of researchers in an institute, Perry-Smith (2006) studied the effect of weak ties on network nonredundancy, defined as the extent to which an individual occupies a position that bridges two otherwise disconnected people. She found that nonredundancy did not mediate the positive relation between researchers' weak ties and creativity. Thus, the mechanism through which employees' weak ties affect their innovation still remains unclear.

In view of this void in the literature, we propose that out-group weak ties may contribute to innovative behavior via high-quality LMX. Our study adds to the original weak-tie theory by adopting a relational perspective to open the black box of the relationship between out-group weak ties and innovative behavior. Innovation is complex and may challenge the established framework of thoughts and routines in a workgroup; thus, employees can rarely convert the information and ideas they obtain from out-group weak ties into actual innovation on their own. Supervisors hold power over the existing state of affairs of a workgroup, and they control the resources that are critical to the success of innovation processes. Thus, employees have to acquire resources from the leader (e.g., inspiration, approval, and backing) in order to further develop, promote, and implement the initial ideas they obtain from outside weak ties (Kanter, 1988).

Drawing on social exchange theory (Blau, 1964; Cropanzano & Mitchell, 2005) and LMX theory (Graen & Uhl-Bien, 1995; Wilson, Sin, & Conlon, 2010), we propose that high-quality LMX will mediate the relationship between out-group weak ties and innovation. First, innovative subordinates may exchange their own resources for high-quality LMX with the leader. Subordinates with many out-group ties can supply their leader with unique benefits, such as valuable information and pockets of diverse knowledge obtained from outside contacts (Granovetter, 1973; Perry-Smith & Shalley, 2003). They can connect their leader to their wide social circles and extend the leader's network and influence in the organization (Sparrowe & Liden, 2005). Upon receiving such benefits from well-connected subordinates, the norm of reciprocity (Gouldner, 1960) will oblige the leader to respond in kind by offering the subordinates high-quality LMX. Second, the high-LMX subordinates are more likely to achieve individual innovation (S. G. Scott & Bruce, 1994), because they not only receive more support and resources from the leader (Graen & Uhl-Bien, 1995) but also enjoy better reputation and higher status in the group (Kilduff & Krackhardt, 1994; Lau & Liden, 2008). The following sections outline our theoretical reasoning in detail.

Outside weak ties and leader–member exchange

We propose that the number of out-group weak ties followers hold is positively related to the quality of the LMX they have with their leader. The LMX theory illustrates the process by which a follower and a leader develop, nurture, and sustain a dyadic relationship via reciprocal social exchanges (Graen & Uhl-Bien, 1995). According to LMX theory, leaders differentiate among followers by developing different exchange relationships with them (Liden & Graen, 1980). These relationships range from those that are based strictly on employment contracts (i.e., low-quality LMX) to those that are characterized by mutual trust, respect, and reciprocal influence (i.e., high-quality LMX; Graen & Uhl-Bien, 1995). In high-quality LMX, leaders exchange strategic advice, social support, feedback, decision-making latitude, and interesting tasks with followers. Followers, in turn, reciprocate by providing valuable information, performing well, and demonstrating commitment to the leader (Liden, Sparrowe, & Wayne, 1997).

However, leader–follower relationships do not exist in a vacuum. Instead, they are embedded in the context of other organizational members and work units (House, Rousseau, & Thomas-Hunt, 1995). Researchers have theorized that followers' social networks in the organization may influence the development of leader–follower

DOI: 10.1002/job

relationships (House et al., 1995; Sparrowe & Liden, 1997). Drawing on previous research (Sparrowe & Liden, 2005), we propose that well-connected individual employees may leverage their out-group weak ties to develop high-quality LMX with their leader.

Subordinates with many out-group weak ties can bring two types of benefits to their leader. First, even though a leader derives assets and power from formal authority, this authority applies only to direct subordinates. To effectively fulfill their leadership role and integrate their workgroup into the broader organizational context, leaders also need information and resources from the outside of their own work unit (Wilson et al., 2010). A subordinate with many out-group weak ties can supply valuable outside resources (e.g., pockets of diverse knowledge, relevant strategic information, word-of-mouth referrals, and influence in the external environment) that help the leader reach his or her goals more efficiently (Granovetter, 1973; Lin, 2001). Second, a leader's ability to develop diverse networks and build strong alliances is crucial to his or her effectiveness (Ferris et al., 2005, 2007). Thus, subordinates with outside weak ties are important to a leader, because they can share information obtained from these ties with the leader and help extend the leader's own information networks in the organization (Sparrowe & Liden, 2005).

Subordinates with many outside weak ties should be well aware of the advantages of their broad network and leverage these connections into positive exchanges with their leaders. First, the well-connected employees may proactively share and discuss the information and ideas they obtain from outside weak ties with their leader. An experienced and expert leader can help those employees translate their pockets of diverse information and nonredundant knowledge into tangible innovative ideas (S. G. Scott & Bruce, 1994; Tierney et al., 1999). Second, because innovation usually challenges the status quo, innovative individuals need their leader's sponsorship and support to promote and implement their ideas in the group. Taken together, employees are motivated to provide the leader with information and resources obtained from outside weak ties, in exchange for feedback, autonomy, and support from the leader. According to social exchange theory (Blau, 1964), a high-quality LMX will eventually evolve between the two parties. Thus, it is reasonable to expect a positive relationship between out-group weak ties and LMX.

Hypothesis 1: The number of out-group weak ties that an employee has will be positively related to LMX.

Leader–member exchange and employee innovative behavior

Furthermore, LMX is expected to have a positive influence on innovative behavior, because the high-LMX follower enjoys more support and resources from the leader to achieve innovation. First, LMX contributes to employee idea generation. High-LMX employees are more likely to obtain domain-relevant knowledge from the leader and ask the leader to share his or her technical expertise and understanding of work-related problems with them. Such knowledge and experience sharing may provide those employees with cognitive stimulation, which inspire them to generate more creative thoughts (Mumford, Scott, Gaddis, & Strange, 2002).

Second, employees with high-quality LMX are more likely to convince other important workgroup members to accept new ideas and build the support and collaboration necessary to realize them (S. G. Scott & Bruce, 1994). According to balance theory (Heider, 1958; Newcomb, 1961), an individual who is perceived to have a close relationship with a prominent person (e.g., the leader) is also likely to be positively perceived by other group members, because there is a strain toward cognitive balance in the perception of observers. As a result, high LMX will boost the focal member's reputation and credibility within the group (Kilduff & Krackhardt, 1994; Lau & Liden, 2008). Members with high-quality LMX are also perceived to be more powerful and influential because they have better access to valuable information and resources from the leader, compared with their low-LMX peers (Sparrowe & Liden, 2005). Consequently, the high-LMX follower will earn the respect and trust of other team members. With the leader's sponsorship, high-LMX members will feel more confident to promote and realize new ideas within the group (Sparrowe & Liden, 2005). Therefore, we hypothesize the following:

DOI: 10.1002/job

Hypothesis 2: Leader–member exchange will be positively related to employee innovative behavior.

Given that we have hypothesized a positive relationship between the number of out-group weak ties and LMX (i.e., Hypothesis 1), we further predict that LMX carries the effect of out-group weak ties on innovation.

Hypothesis 3: Leader–member exchange will mediate the relationship between the number of out-group weak ties and employee innovative behavior.

Interaction effect between leader–member exchange and within-group strong ties

An individual's within-group networks include not only his or her relationship with the leader but also relationships with peers in the group. Social exchange theory (Blau, 1964; Cropanzano & Mitchell, 2005) describes how an individual develops and maintains relationships with leader and peers, respectively; but the theory does not speak to how the two within-group relations interact to influence employee outcomes (Cole et al., 2002). To better understand the exchange dynamics within the group, we focus on individuals' within-group strong ties and explore how such relationships interact with LMX to impact employee innovative behavior.

According to social network theory (Granovetter, 1973; Krackhardt, 1992), tie strength, ranging from weak ties at one extreme to strong ties at the other, can be used to describe the quality of within-group peer relationships. Strong ties with peers are characterized by frequent interactions, high emotional closeness, and reciprocity (Perry-Smith & Shalley, 2003). Previous research has found that both weak ties (Baer, 2010; Perry-Smith, 2006) and strong ties (Hansen, 1999; Kijkuit & van den Ende, 2010) may facilitate the innovation process. As stated earlier, the advantages of outside connections are optimized by weak ties, which connect the focal individual to a wide range of social circles. However, when it comes to peer relations within the group, we argue that strong ties are an important channel for innovators to obtain inspiration, sponsorship, and support (Kanter, 1988). Specifically, we propose that within-group strong ties may *substitute* the role of LMX in facilitating innovation, such that the positive relationship between LMX and innovative behavior is stronger when the number of within-group strong ties is low. And LMX will become less important for innovation when the number of within-group strong ties is high.

There are several reasons why within-group strong ties can substitute the effect of high LMX on innovation. First, within-group strong ties facilitate knowledge exchange with co-workers and help create a solid knowledge base from which innovative ideas will emerge (Reagans & McEvily, 2003). More importantly, within-group strong ties may replace the role of LMX in stimulating new ideas. Strong-tie contacts usually have frequent communication and thorough discussion on work-related issues, which may not occur between followers and leaders, given that leaders have limited time to spend with each follower. In-depth discussions among members can enhance the individual's tacit knowledge and help him or her redefine the dimensions of a problem (Cross & Sproull, 2004; Mumford & Gustafson, 1988; Simonton, 1999). Co-workers may also be able to offer a broader spectrum of idea-generating information and advice than the leader can. Additionally, constant feedback from strong-tie contacts may help the individual adjust and improve creative ideas and make these ideas more feasible (De Stobbeleir, Ashford, & Buyens, 2011).

Second, the role of LMX in facilitating new idea promotion and implementation becomes less important in the presence of within-group strong ties. Innovations can change the way a group does its work, which directly impacts other group members. Thus, their support and buy-in are crucial for the success of the innovation (Axtell, Holman, Unsworth, Waterson, & Harrington, 2000; Van de Ven, Angle, & Poole, 1989). An individual with many strong ties in a group can create trust in co-workers and establish credibility and status within the group (Kilduff & Krackhardt, 1994; Levin & Cross, 2004). Thus, it is easy for the focal individual to obtain sponsorship for new ideas and secure the requisite resources and help from other members to implement them (Podolny & Baron, 1997). In other words, within-group strong ties may reduce an employee's dependence on the leader for idea promotion and implementation.

DOI: 10.1002/job

Third, individuals may resort to strong ties for emotional support during the innovation process (Jokisaari, 2013; Krackhardt, 1992). Innovative employees are likely to be confronted by individuals who resist change because of the insecurity and uncertainty it brings. It can be difficult and emotionally demanding for innovators to convince others of the benefits of innovation (Janssen, 2004). Within-group strong ties can provide emotional support and feedback to help innovative employees cope with the stress and resistance incurred during idea promotion and implementation (Krackhardt, 1992). The validation for the creative ideas from strong-tie contacts can bolster the innovator's confidence and encourage him or her to promote the ideas more persuasively (Cross & Sproull, 2004). Unlike leader–follower relationships, peer relationships do not cross hierarchical boundaries. Co-workers usually interact more frequently and face similar work-related issues and concerns. Thus, strong-tie contacts can easily empathize with the innovative employee and provide comfort and encouragement during the innovation process (Jokisaari, 2013).

To summarize, when an innovative employee has established a significant number of within-group strong ties, LMX becomes less important for the pursuit of innovation, because those strong ties may serve as an alternative way for the focal employee to seek inspiration and feedback for creative ideas and to obtain approval and sponsorship to implement them. In contrast, when within-group strong ties are absent, LMX will play an important role in facilitating innovative behavior. The preceding arguments lead to the following hypothesis:

Hypothesis 4: The number of within-group strong ties that an employee has will moderate the relationship between LMX and employee innovative behavior, such that the positive relationship is weaker when the number of within-group strong ties is high.

In sum, we propose that employees' out-group weak ties will have an indirect relationship with their innovative behavior through high-quality LMX. This indirect relationship will be conditional on the moderator variable of within-group strong ties for the path from LMX to innovative behavior. As such, this moderated mediation model clarifies why (high-quality LMX) and when (low number of within-group strong ties) out-group weak ties result in innovative behavior. To test this moderated mediation model, we formulate the following hypothesis:

Hypothesis 5: The indirect relationship between the number of out-group weak ties and employee innovative behavior is mediated by LMX and moderated by the number of within-group strong ties for the path from LMX to innovative behavior, such that the indirect relationship is weaker when the number of within-group strong ties is high.

Method

Sample and procedure

This study was conducted in an entrepreneurial firm, which we will identify as "SCOS." This firm has 135 employees and was founded in 2002 in southeast China. Prior to the data collection, the authors visited the firm and conducted in-depth interviews with seven personnel: the CEO, three supervisors, and three staff members. The objective of these interviews was to understand the research setting, the value placed on innovation, and the level of social interaction occurring within the firm.

SCOS was a small firm dedicated to designing and developing smart card middleware and operating systems, developing applications and solutions based on smart cards, and distributing smart cards in China and overseas. Their products were extensively used in the telecommunication and finance industries. The market in which this firm operated was fiercely competitive and growing at 10% annually. In order to remain competitive, SCOS had focused on research and development (R&D) and marketing innovation to more effectively and efficiently develop and distribute products than its competitors. SCOS had three broad departments: R&D, Marketing and

DOI: 10.1002/job

Sales, and Supporting (i.e., Admin, Finance, and Human Resource). SCOS's staffing model was aligned with its strategic focus on innovation: 59% of employees worked on product development, technical design, and technical support; and 30% of employees worked on marketing and sales. Finally, like other contemporary organizations, SCOS required its employees to work interdependently; thus, any innovations generated through the efforts of individual employees would more or less require support from both supervisors and peers. Given this corporate culture, we believe that SCOS provided an interesting array of opportunities for studying employee innovative behavior.

In addition to valuing innovation, SCOS had a very flat organizational structure and a relatively stable work structure. For example, the entire firm had only three formal levels (department heads, supervisors of work-groups within the departments, and staff within the work-groups). Thus, both horizontal and vertical communication frequently took place, as vertical communication was only one level up from their immediate supervisors. Furthermore, within each functional department (e.g., R&D and Marketing), employees were assigned to different workgroups with distinct tasks and goals. This is a common structure in traditional industrial firms. Although communication did occur across groups for business-related reasons, our interviews and on-site observations revealed that employees were strongly affiliated with their respective workgroups. In addition, the members of each workgroup were physically collocated. The clear boundaries between groups made it easy for employees to differentiate between within-group and outside-group colleagues. In this context, an employee's within-group ties were connections with members of his or her workgroup, whereas out-group ties were connections with members of other workgroups. Thus, it is likely that out-group ties could bring in new information and fresh perspectives. There were 16 workgroups in the firm, with an average group size of 8.4 members. We included all workgroups in our survey study.

In order to obtain a complete picture of the organizational social network, we administered an online survey to all 135 employees. The entire survey was translated from English into Chinese and then back-translated into English so as to guarantee equivalency of meaning (Brislin, 1980). In order to avoid common method biases, the survey was administered in three waves: (1) to all employees to solicit information on their social ties; (2) to supervisors to rate their direct reports' innovative behavior; and (3) to employees to rate LMXs with their supervisor. The time interval between waves was approximately 2 weeks. All 135 employees participated in the online survey (100%). However, 15 respondents did not complete all of the sections of the survey. Because these respondents did respond to most variables, we treated their nonresponses as missing values.

We used the full-information maximum likelihood method for missing-data treatment, which is a more robust technique than list-wise deletion, pairwise deletion, mean replacement, or multiple imputation methods (Arbuckle, 1996; Bollen & Curran, 2006; Little & Rubin, 2002). All models were rerun using the cases with no missing values, to ensure that our treatment of missing data did not adversely impact our findings. The results remained unchanged.

The average age of the employees was 26 years, 85% were less than 30 years old, 63% were male, and 74% had a bachelor's or master's degree. The average organizational tenure of the employees was 2.3 years.

Measures

Employees' innovative behavior

The immediate supervisors assessed employee *innovative behavior* using Janssen's (2000, 2001) nine-item scale (three items for each dimension), which draws on Kanter's (1988) work on the components of individual innovation. A sample item is "(the employee) creates new ideas for improvements" (1 = *never* and 7 = *always*). A series of confirmatory factor analysis (CFA) models were conducted to evaluate the factor structure of the innovation scale. The best-fit model was a first-order model with all the items loading directly on the innovative behavior factor [$\chi^2_{(df=15)} = 15.5$, CFI = 0.99; TLI = 0.99; RMSEA = 0.02]. We then used this factor structure for innovative behavior in subsequent analyses.

DOI: 10.1002/job

Leader–member exchange

Leader–member exchange was measured by the LMX Multidimensional Measure scale (Liden & Maslyn, 1998), which includes four dimensions: affect, loyalty, contribution, and professional respect. A sample item is "My supervisor is the kind of person one would like to have as a friend" (1 = *strongly disagree* and 7 = *strongly agree*). We conducted a second-order CFA model to assess the construct validity of the LMX scale. The model had four first-order factors (i.e., the four dimensions) and one second-order LMX factor. The fit indices of the model were relatively poor [$\chi^2_{(df=41)} = 140.93$, $p = .00$; CFI = 0.93; TLI = 0.90; RMSEA = 0.14], mainly owing to the poor loading of the professional respect dimension. We then ran another second-order model without the professional respect items; the result showed a better fit [$\chi^2_{(df=18)} = 20.70$, $p = .30$; CFI = 0.99; TLI = 0.99; RMSEA = 0.03]. The original work of Dienesch and Liden (1986) proposes that LMX should include three dimensions: affect, loyalty, and contribution. Liden and Maslyn (1998) added professional respect as an ad hoc dimension, based on their interviews with participants. In other words, there is a lack of theoretical delineation for including professional respect as an LMX dimension. Drawing on Dienesch and Liden (1986), it is reasonable to argue that the three dimensions (i.e., affect, loyalty, and contribution) capture the essence of the LMX construct. Hence, in subsequent analyses, we used the three-dimensional LMX scale, which contains nine items (i.e., three items for each dimension).

Out-group weak ties and within-group strong-ties

To assess the number of weak ties outside the workgroup and the number of strong ties within the workgroup, we collected data on social networks using the roster method, which is known to be more reliable than simple name-generator techniques (J. P. Scott, 2000; Wasserman & Faust, 1994). In this method, respondents were provided with an alphabetical name list of all their colleagues. The names on the list were then grouped by department to minimize participant fatigue and make it easy for respondents to locate their colleagues. This method helped overcome potential recall biases and, thus, more accurately represent relationship patterns (Nooy, Mrvar, & Batagelj, 2005; J. P. Scott, 2000; Wasserman & Faust, 1994). We asked respondents to examine the list of their *colleagues* and indicate their frequency of social interactions in the organization setting (1 = *never*, 2 = *once a year*, 3 = *several times a year*, 4 = *several times a month*, 5 = *several times a week*, 6 = *once a day*, and 7 = *several times a day*; Brass, 1981; Mehra, Kilduff, & Brass, 2001).

Strong and weak ties were defined based on the frequency of interaction (Marsden, 1990). Interactions that took place "once a year," "several times a year," or "several times a month" were categorized as weak ties; interactions that took place "several times a week," "once a day," or "several times a day" were categorized as strong ties. We identified whether a tie was within or outside a workgroup by using the company's organization structure chart. The numbers of weak ties outside of each individual's workgroup were counted. Workgroups were not the same size. In order to compare the numbers of within-group strong ties across groups of different sizes, we divided the number of within-group strong ties by maximum possible within-group ties (i.e., $N - 1$, where N is respective group size).

Control variables

We used employee age, gender, and tenure as control variables for innovative behavior in our models.

Data analysis strategy

In our sample, employees were nested within their mangers. Thus, multilevel modeling may seem to be an appropriate choice for data analysis, in order to control for the potential interdependence among individual observations within the same group (Bauer, 2003; Curran, 2003). However, there were only 16 groups in our sample. This number is much lower than appropriate Level-2 sample size recommended by the multilevel modeling literature (Scherbaum & Ferreter, 2009). For example, Kreft (1996) recommended a minimum of 30 groups for multilevel analysis. Hox and his colleague advocate an even larger sample size with at least 50 groups (Hox, 1998; Maas & Hox, 2005). Given the relatively small sample size at Level 2 (i.e., only 16 groups) in our sample, we may not have

DOI: 10.1002/job

sufficient statistical power in multilevel modeling to obtain accurate estimation for the hypothesized effects (Scherbaum & Ferreter, 2009).

In order to evaluate the degree of within-group interdependence in our data, we proceeded to calculate the ICCs and design effects for all the variables in our model. None of the variables had a significant ICC (all ICCS were lower than 0.08) or a design effect larger than 1.6. These results indicate that there was no significant group-level variance in the variables. In other words, even if our followers were nested in groups, their group membership did not count for significant variance in the variables and thus did not need to be controlled for by multilevel modeling. In such a case, single-level analysis is recommended by researchers (Cohen, 1988; Hox & Maas, 2001; Maas & Hox, 2004). Therefore, we relied on single-level structural equation modeling (SEM) as the main method to test our model, but we also conducted multilevel SEM as a supplement method. In the Results section, the results from both single-level and multilevel SEM are reported.

Specifically, we used covariance-based SEM (Qureshi & Compeau, 2009), which is a second-generation multivariate analytic technique that simultaneously estimates measurement and structural models (Bollen, 1989). SEM can incorporate measurement error, assess overall model fit, and permit simultaneous estimation of multiple associations (Cheung, 2009; James, 2008; James, Mulaik, & Brett, 2006; Preacher, Rucker, & Hayes, 2007). We followed Anderson and Gerbing's (1988) two-step analytical strategy to test our hypothesized model. First, a measurement model was performed to test the construct validity of two constructs with multiple indicators: LMX and innovative behavior. Second, a series of nested structural models were conducted to estimate the fit of the hypothesized model to the data. We then assessed the significance of the path estimates to test the hypotheses.

To test mediation, we followed recommendations for examining the significance of indirect effects (Preacher & Hayes, 2008; Shrout & Bolger, 2002) using the bias-corrected bootstrapping approach (MacKinnon, Lockwood, & Williams, 2004). To test the moderated mediation relationship, we followed the procedure outlined by Preacher et al. (2007) and estimated the indirect effects (and confidence intervals for the effects) of out-group weak ties on innovation via LMX at different numbers of within-group strong ties.

Results

Table 1 presents the descriptive statistics and zero-order correlations of the variables. For LMX and innovative behavior, latent variable scores were reported.

Table 1. Descriptive statistics and correlations.

Variables	Mean	*SD*	1	2	3	4	5	6	7
1. Age	26.43	2.88	—						
2. Gender[a]	0.58	0.50	.10	—					
3. Tenure	1.9	1.48	.39**	.11	—				
4. Outside-group weak ties	17.34	16.9	.15*	−.11	.18*	—			
5. Within-group strong ties	0.38[b]	0.19	−.04	−.00	.07	.13	—		
6. Leader–member exchange	5.24	1.29	.12	−.06	.06	.25**	.14	(.81)	
7. Innovative behavior	3.37	1.71	.04	.01	.11	.20*	.11	.27**	(.95)

Note. $N = 135$. Internal consistency reliabilities appear in parentheses along the diagonal.
[a]Female = 0.
[b]In order to control for group size, we divided the number of within-group strong ties with maximum possible within-group ties (i.e., $N - 1$, where N is the respective group size).
$^{**}p < 0.01$, $^{*}p < .05$.

DOI: 10.1002/job

Measurement model

The measurement model consisted of two constructs that had multiple indicators: LMX and innovative behavior. The results indicated a good fit to the data [$\chi^2_{(df=106)} = 123.31$, $p = .12$; $\chi^2/df = 1.03$; CFI = 0.99; incremental fit index (IFI) = 0.99; TLI = 0.99; RMSEA = 0.04]. All factor loadings were significant at the .05 level, which supported the construct validity of the LMX and innovative behavior scales.

Structural model

First, we used a simple model to test the direct effect of out-group weak ties on innovative behavior, which was significant ($\beta = .19$, $p < .05$). This direct effect became marginally significant ($\beta = .15$, $p = .09$) when we introduced control variables for employee age, gender, and tenure. None of the control variables were significant. This model fit the data very well: $\chi^2_{(df=47)} = 48.91$, $p = .40$; $\chi^2/df = 1.04$; CFI = 0.99; IFI = 0.99; TLI = 0.99; RMSEA = 0.02.

Second, we constructed a mediation model. We included indirect effects from out-group weak ties through LMX to innovative behavior, in addition to the aforementioned direct effect. This model had a good fit: $\chi^2_{(df=165)} = 184.44$, $p = .19$; $\chi^2/df = 1.12$; CFI = 0.99; IFI = 0.99; TLI = 0.99; RMSEA = 0.03. The path from the number of out-group weak ties to LMX was significant ($\beta = .26$, $p < .01$), supporting Hypothesis 1. The path from LMX to innovative behavior was also significant ($\beta = .22$, $p < .05$), supporting Hypothesis 2.

Moreover, after introducing the indirect effect, the direct effect of outside-group weak ties on innovative behavior became nonsignificant ($\beta = .11$, $p > .10$), suggesting a full-mediation effect. To test the significance of indirect effect, we conducted a bias-corrected bootstrapped test with 5000 replications to construct confidence interval (Preacher & Hayes, 2008). The indirect effect of out-group weak ties on innovative behavior was 0.043 (bias-corrected lower bound = 0.02; bias-corrected upper bound = 0.09; two-tailed p-value = .027). Thus, Hypothesis 3 was supported.

In the third step, we introduced the number of within-group strong ties as the moderator (see Figure 2 for the SEM). This model had a good fit: $\chi^2_{(df=307)} = 344.79$, $p = .07$; $\chi^2/df = 1.12$; CFI = 0.99; IFI = 0.99; TLI = 0.99; RMSEA = 0.03. The interaction effect of within-group strong ties and LMX on innovation was significant ($\beta = -.25$, $p < .01$). In order to test the significance of the relationship between LMX and innovative behavior at different levels of within-group strong ties, we calculated the simple slopes for within-group strong ties one standard deviation (1*SD*) above and below the mean. As shown in Figure 3, the relationship between LMX and innovative behavior was not significant when the number of within-group strong ties was 1*SD* above the mean ($b = 0.08$, $p = .09$). However, the relationship was very strong when the number of within-group strong ties was 1*SD* below the mean ($b = 0.41$, $p < .001$). Therefore, Hypothesis 4, which stated that an individual's number of within-group strong ties would negatively moderate the relationship between LMX and innovative behavior, was supported.

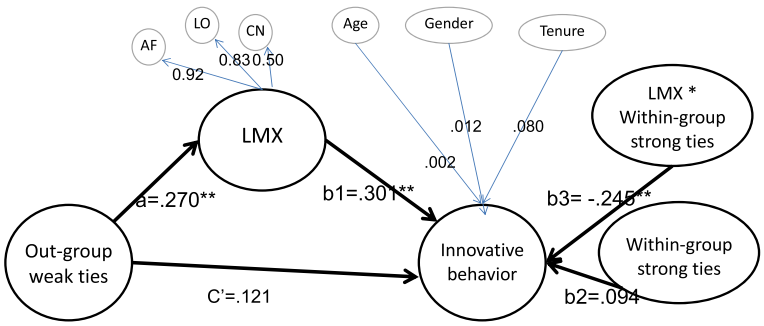

Figure 2. Structural equation modeling analytical model and results. AF, affect; CN, contribution; LMX, leader–member exchange; LO, loyalty

DOI: 10.1002/job

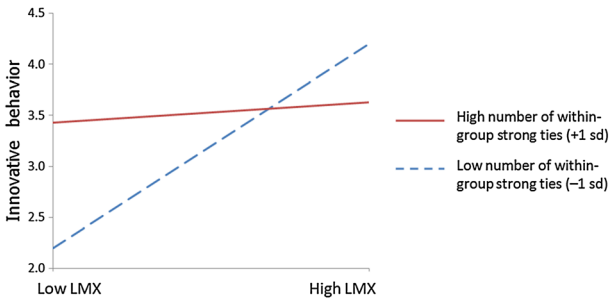

Figure 3. Within-group strong ties as a moderator of the relationship between leader–member exchange (LMX) and innovative behavior

Hypothesis 5 predicted that an individual's number of within-group strong ties would negatively moderate the indirect effect of out-group weak ties on innovative behavior via LMX, such that the indirect relationship was weaker only when the number of within-group strong ties was high. To test this hypothesis, we conducted bootstrap to obtain a bias-corrected confidence interval. We obtained moderated indirect effects for the two values of moderator: (i) mean plus 1*SD* and (ii) mean less 1*SD*. The indirect effects were not significant for mean + 1*SD* (estimate = −0.013, bias-corrected lower bound = −0.089; bias-corrected upper bound = 0.048, for 95% confidence level). The indirect effects were significant for mean − 1*SD* (estimate = 0.093, bias-corrected lower bound = 0.041; bias-corrected upper bound = 0.121, for 95% confidence level). Thus, the indirect effect was significant only when the number of within-group strong ties was low, lending support to Hypothesis 5.

We also conducted additional analysis using multi-level SEM to control for potential interdependence among individual observations within the same workgroup (Bauer, 2003; Curran, 2003). We used the MPLUS version 7.0 software for this analysis. As all our variables were at the individual level, we used a 1–1–1 model, with second-stage moderation effect. The results from MPLUS remained unchanged, suggesting that interdependence among individual observations did not have a significant impact on the substantive relationships in our model.[1] These findings ensured the robustness of our results from single-level SEM.

Supplementary analysis

Besides out-group weak ties and within-group strong ties, an employee also holds two other types of ties: out-group strong ties and within-group weak ties. In a *post hoc* analysis, we examined the impacts of these two alternative types of social ties on innovative behavior. Specifically, we tested an alternative SEM, in which out-group weak ties was replaced by out-group strong ties, and within-group strong ties replaced by within-group weak ties. The results showed that the number of out-group strong ties and LMX was not significant ($\beta = .08$, $p > .10$), suggesting that it is out-group weak ties, rather than out-group strong ties, that are beneficial for developing a high-quality LMX with the leader. Furthermore, the interaction effect between LMX and the number of within-group weak ties on innovative behavior was not significant ($\beta = .08$, $p > .10$), suggesting that it is within-group strong ties, rather than within-group weak ties, that substitute the effect of LMX on innovation. In summary, these results further confirmed the validity of our findings regarding the importance of out-group weak ties and within-group strong ties.

[1]The MPLUS results are available upon request from the first author. It should be noted, however, that we encountered convergence issues in MPLUS. Several runs in MPLUS terminated without convergence with an error message "number of clusters less than parameters being estimated." This was because there were only 16 clusters (i.e., groups) in our data. On several runs, we also received message indicative of not enough variance at the group level. Repeated trial with changing "MITERATION" and "STARTS" options in MPLUS finally resulted in a converged solution. However, the warning messages of lower number of clusters and of not enough variance at the group level indicated problems of using multilevel modeling for our dataset.

DOI: 10.1002/job

Discussion

Our findings can be summarized as follows. First, we found that LMX fully mediated the positive relationship between the number of out-group weak ties and innovative behavior. Second, the number of within-group strong ties negatively moderated the relationships between LMX and innovation, such that the relationship was significant only when the number of within-group strong ties was low. Finally, the number of within-group strong ties negatively moderated the indirect effect of out-group weak ties on innovation via LMX, such that the indirect effect was significant only when the number of within-group strong ties was low.

Theoretical contributions

This study answers the question of why and when out-group weak ties may facilitate innovative behavior. First, we contribute to weak-tie theory and the innovative literature by revealing the mechanism through which out-group weak ties may contribute to innovative behavior. The weak-tie theory applied to the creativity (i.e., idea generation) literature (Granovetter, 1973; Perry-Smith, 2006) emphasizes the information benefits of weak ties. However, the empirical test to the mediation effect of nonredundant information yielded inconclusive results (Perry-Smith, 2006). Our study extends weak-tie theory by revealing the *relational* benefits of weak ties for innovation. That is, the widely connected individual may leverage the information and knowledge obtained from out-group weak ties to develop a high-quality LMX with the leader, which in turn facilitates innovation. This finding suggests that the advantages of weak ties are not limited to information benefits; they may also help the focal individual mobilize resources, endorsements, and support from the leader to achieve innovation.

It should be noted that the result of our additional analysis showed that the number of outside strong ties was not related to LMX. Taken together, the relational benefits of out-group ties are more likely to be provided by out-group weak ties rather than by out-group strong ties. An employee with many out-group weak ties has unique access to a wide range of social circles or groups (Burt, 1997; Granovetter, 1982). Information flowing via those outside weak ties is more likely to be fresh and nonredundant because it emanates from diverse sources (Perry-Smith & Shalley, 2003). In contrast, strong ties tend to form dense networks of similar individuals, in which most of the individuals have some type of relationship to one another (Granovetter, 1973). Information that conveys through strong ties tends to travel circular paths and thus is likely to be more redundant and less fresh (Perry-Smith & Shalley, 2003). In addition, the time and energy required to maintain strong ties may prevent the focal individual from searching for other outside sources for new insights and novel information (Hansen, 1999). Taken together, it seems reasonable to conclude that outside weak ties are better able to provide valuable information resources to the leader than outside strong ties.

The second contribution of this study is that we advance the LMX theory by identifying out-group weak ties as an antecedent of LMX. To date, investigations of LMX antecedents have lagged far behind studies examining consequences of LMX (Erdogan & Bauer, 2014). Our study is among the first to explore LMX antecedents from the social network perspective. Thirdly, our study advances social exchange theory by demonstrating how different exchange relationships may interact to influence innovation. Social exchange theory has been widely used to describe interpersonal relationships in the work setting (Cropanzano & Mitchell, 2005); however, the question of how peer relationships and leader–member relationships combine and interact in their effects has not been explored (Cole et al., 2002). We fill this gap by finding that within-group strong ties can substitute for the function of LMX in facilitating innovation. Previous studies have documented the benefits of LMX for employee innovative behavior (S. G. Scott & Bruce, 1994; Tierney et al., 1999). In reality, it may not be feasible for a leader to pay close attention to all their team members and give them sufficient feedback and support for individual innovation. Our results suggest that strong ties with peers in the group can replace the role of LMX in facilitating innovative behavior. Actually, peers in the group may offer some advantages over the leader. For instance, strong-tie contacts in the group are more likely to

DOI: 10.1002/job

provide inspiration and feedback through daily interactions, thus benefitting idea generation and improvement. The advocacy and sponsorship of strong-tie contacts can also help the innovator promote and realize new ideas in the group. Furthermore, the emotional support of peers is crucial in helping the innovator overcome uncertainty and stress during the innovation process. Thus, LMX is less important for stimulating innovation when an employee holds many within-group strong ties.

Our fourth contribution is that our results help reconcile the long-standing debate about the effect of tie strength on innovation. Researchers have yet to reach a consensus on the influence of tie strength on innovation because the evidence has shown that both strong ties (Hansen, 1999; Kijkuit & van den Ende, 2010) and weak ties (Baer, 2010; Perry-Smith, 2006) can facilitate innovation. Our findings suggest that the function of tie strength may depend on the location of the contacts. For contacts outside the work unit, weak ties may be more efficient in connecting the focal individual with a broad range of people with diverse backgrounds and fresh perspectives. However, for peers within the group, frequent interactions with strong-tie contacts seem to be crucial for the individual to ruminate the fresh information and perspectives obtained from the outside and translate them into creative ideas. Furthermore, strong-tie contacts also provide the individual with necessary feedback, support, and resources to refine and realize their creative ideas. To summarize, out-group weak ties and within-group strong ties may complement each other in facilitating innovative behavior in the organization.

Limitations and future research

This study has several limitations. First, consistent with the social network approach, we only examine the effect of the number of social ties. Although there is evidence that more social ties do provide more task-relevant and diverse information (Anderson, 2008), future research linking social ties and innovation could more explicitly incorporate the content of social ties in addition to the number of ties. Second, we assessed LMX from the follower's perspective. Follower-rated LMX is a common practice in the literature (Hiller, DeChurch, Murase, & Doty, 2011), and it seems appropriate in our study, in the sense that the follower's perception of LMX is more likely to drive his or her innovative behavior than the leader's perception of LMX. However, the follower perception measure may not perfectly capture the reciprocal process in which the leader forms a high-quality LMX in exchange for the information and resources provided by a well-connected follower. We encourage further studies to measure LMX from the leader perspective in order to fully reveal the dynamic social exchange process between the two parties.

Third, although we theorize that out-group weak ties may facilitate individuals to develop high LMX, it is possible that these two types of relationships may be both influenced by some individual characteristics. For example, Phillips and Bedeian (1994) suggested that extraverts are more likely to seek interactions and develop interpersonal relations with others. Future research should examine whether the relationship between outside weak ties and LMX is still significant after relevant personality traits, such as extroversion, are controlled for.

Fourth, our data came from China, whose cultural values differ from those in Western societies (Hofstede, 2001) from which social network and leadership theories originate. Although our findings aligned with the predictions of the aforementioned theories, they might have been influenced by cultural values. Specifically, Chinese people are known to emphasize interpersonal relationships in the workplace (Chen, Chen, & Huang, 2013). Thus, Chinese leaders may be more likely to recognize the value of employees who are widely connected to the outside environment and be more willing to develop and maintain high-quality relationships with them. Future research should examine if our results can be replicated in Western cultures.

Practical implications

The results of this study have several managerial implications. First, to foster innovation, organizations should encourage more interdepartmental communication among employees from different teams or functions. For example,

DOI: 10.1002/job

companies can organize cross-department brainstorming sessions to inspire innovation (Sutton & Hargadon, 1996). This practice would help employees develop weak ties outside of their immediate group, which will benefit their individual pursuits of innovation.

Second, managers should realize the importance of within-group strong ties for employee innovative behavior. Managers should not only recruit for a certain personality profile (e.g., extroverted and agreeable) but also provide subordinates with opportunities to develop strong ties with each other. For example, managers may arrange regular team-building activities or after-work events that help team members build trust and attachment. Of course, during the early stage of team formation, when strong ties are absent, one-on-one interactions between a leader and his or her followers play a pivotal role in cultivating innovation. Leaders should establish strong LMX with their followers, share their expertise and experience to inspire creativity, and provide the necessary approval and sponsorship to realize the ideas. However, in later stages of team development, when team members have established strong ties among each other, managers could grant more autonomy to followers and focus less on one-on-one interactions. Instead, they could spend more time on fostering a climate for innovation (N. R. Anderson & West, 1998)—by articulating a compelling group vision, encouraging constant performance improvement, and ensuring that team members feel safe to propose new ideas to the group.

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