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### Co-worker trust and knowledge creation: A multilevel analysis

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## Co-worker trust and knowledge creation: A multilevel analysis

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Prior research on trust and knowledge creation has primarily focused on organisational or team-level knowledge creation and the dyadic nature of trust without considering social contexts. This study explores how the extent to which team members are trusted by teammates in their networks (co-worker trust) is associated with the creation of new knowledge in a knowledge-intensive team setting. In addition, the study investigates the moderational effects of task interdependence on the relationship between co-worker trust and knowledge creation. Using a sample of 194 research scientists working in 48 knowledge-intensive teams, our results reveal that team members who are highly trusted by co-workers are more likely to create new knowledge. The positive relationship between co-worker trust and knowledge creation was strongest under conditions of high task interdependence. The discussion addresses the importance of understanding the role of co-worker trust in enhancing knowledge creation and highlights the importance of task contexts. Practical implications for knowledge-intensive teams are discussed.

**Keywords:** social networks; co-worker trust; knowledge creation; task interdependence; teams

The creation of new knowledge has been recognised as one of the most valuable resources in today's organisations (McFadyen, Semadeni, & Cannella, 2009). In the context of highly competitive markets, globalisation, and rapidly advancing technology, knowledge-based resources and capabilities that are created by employees can help a firm to obtain a competitive advantage (DeNisi, Hitt, & Jackson, 2003). Knowledge created by team members is especially critical to the effectiveness of knowledge-intensive teams such as science research laboratories, whose primary goal is to produce new knowledge that contributes to new scientific discoveries (McFadyen & Cannella, 2004).

Despite the importance of individual level interactions, most research on knowledge creation has focused on organisational knowledge and organisational-level processes (Felin & Hesterly, 2007; Miller, Fern, & Cardinal, 2007; Nonaka, 1994; Nahapiet & Goshal, 1998) or on team-level processes (Hülsheger, Anderson, & Salgado, 2008; Schulze & Hoegl, 2006). However, knowledge is inherently an individual-level construct (Jackson, Chuang, Harden, & Jiang, 2006) and knowledge creation is partly an individual activity (Grant, 1996). Nevertheless, prior research has seldom examined individual-level knowledge creation (for exceptions, McFadyen

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& Cannella, 2004, 2005). This study examines how scientists create new knowledge in a knowledge-intensive team context. Following McFadyen and Cannella (2004), we defined new knowledge as an individual's new scientific discoveries (p. 735).

Previous theoretical and empirical work has suggested that trust embedded in interpersonal networks plays a crucial role in facilitating the exchange of tacit knowledge and as a result, trust contributes to new knowledge creation (for example, Nahapiet & Ghoshal, 1998; Yli-Renko, Autio, & Sapienza, 2001). Trust refers to an individual's willingness to be vulnerable to the actions of another person without being afraid of the other person's opportunistic behaviours (Mayer, Davis, & Schoorman, 1995). Since trust promotes social exchange relationships (Blau, 1964) and risk-taking (Colquitt, Scott, & LePine, 2007; Mayer et al., 1995), individuals are more willing to provide non-codifiable tacit knowledge (e.g. know-how and experiences) and confidential information to others they trust. Hence, individuals who are trusted by teammates in their networks are more likely to gain a larger volume of tacit and confidential knowledge and therefore are better able to create new knowledge.

Although being trusted by co-workers plays a critical role in the creation of new knowledge, scholars have devoted scant effort to examining how the degree to which individuals are trusted by co-workers in their networks, which we refer to as *co-worker trust*, contributes to knowledge creation by individuals working in a team context. Prior research on trust has primarily focused on trust in leaders/leadership or examined the dyadic nature of trust without considering the social context of such relationships (Ferrin, Dirks, & Shah, 2006; Lau & Liden, 2008). In today's turbulent business environment, it is rare for knowledge workers to work in isolation; collaboration and coordination are essential aspects of the work context. Thus, understanding co-worker trust is important to managing teams and organisations effectively. This study aims to advance understanding of how being trusted by one's teammates contributes to individual knowledge creation.

Another purpose of this research is to explore how the team context influences the relationship between co-worker trust and knowledge creation. Specifically, we consider as a contextual factor the extent to which tasks require team members to work interdependently (Saavedra, Earley, & Van Dyne, 1993), which we refer to as *task interdependence*. Task interdependence may moderate the relationship between co-worker trust and knowledge creation. High task interdependence may increase activities to develop skills and knowledge through work coordination and mutual adjustment among team members and may facilitate interpersonal interactions between team members (Thompson, 1967). In addition, in highly interdependent situations, team members who are trusted by teammates may acquire critical knowledge and information more easily and, as a result, are more likely to create new knowledge.

Figure 1 summarises the proposed relationships examined in this study. We seek to improve our understanding of the relationships between individual co-worker trust and new knowledge creation in knowledge-intensive teams, taking into consideration the potential moderating effect of a team context: task interdependence.

### **Co-worker trust and knowledge creation**

Embedded within social networks are a variety of resources that can ease tacit knowledge transfer and new knowledge creation. Among these, trust has been

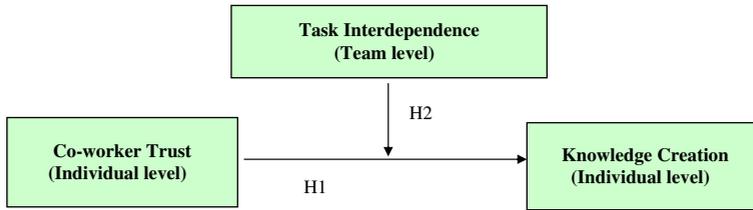


Figure 1. Hypothesised model.

identified as one of the most important potential resources embedded within a network of relationships (Nahapiet & Ghoshal, 1998). Numerous studies have suggested that trust may facilitate the acquisition and transfer of tacit knowledge and the creation of new knowledge (Abrams, Cross, Lesser, & Levin, 2003; Dirks & Ferrin, 2001; Lui, 2009; Mooradian, Renzl, & Matzler, 2006; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998).

Prior research has found that the dyadic trust between a trustor and a trustee contributes to task performance and citizenship behaviour (for a meta-analytic review, see Colquitt et al., 2007), as well as job satisfaction (Matzler & Renzl, 2006). However, examining dyadic trust in isolation from the larger social context in which such relationships exist may provide an incomplete understanding of trusting relationships within team-based organisations (Ferrin et al., 2006).

Trust is defined as ‘the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party’ (Mayer et al., 1995, p. 712). Although others define trust as a personality characteristic (e.g. Rotter, 1967), we define trust as an aspect of interpersonal relationships following Mayer et al. (1995), Schoorman, Mayer, and Davis (2007), and Rousseau, Sitkin, Burt, and Camerer (1998). Trust research across different disciplines (e.g. sociology or economics) agrees that views of risk and the perceived likelihood of loss are central to the understanding of trust (Gillespie, 2003; Rousseau et al., 1998; Sheppard & Sherman, 1998). Since the level of trust increases the level of risk that an individual is willing to take in the relationship, trust may facilitate risk-taking behaviours (e.g. sharing information and knowledge) (Dirks & Ferrin, 2001; Mayer et al., 1995; Schoorman et al., 2007). A high level of trust in a co-worker increases the likelihood that one will take a risk with the person by sharing confidential information (Dirks & Ferrin, 2001). When an individual (or a trustor) trusts a colleague (or a trustee), he/she is not concerned about the trustee’s potential adverse behaviours; thus, trust may enable more active knowledge sharing.

In a context of formal contracts and specific agreements between a trustor and a trustee, sharing of information involves low risk, because the trustee’s behaviour is monitored. However, in the absence of formal contracts and specific agreements, a trustor takes risks in the relationship and accepts the possibility that a trustee may fail to meet obligations or expectations. In team-based organisational structures, relationships cannot always be controlled by formal organisational procedures or policies and tasks inherently entail risk-taking (Mayer et al., 1995). Since trust allows team members to expect social and economic exchange (conditional trust) and/or to perceive shared values and positive mood and emotions (unconditional trust) (Jones & George, 1998), such expectations and positive affective states promote knowledge

acquisition and transfer; that is, acquiring tacit knowledge that contributes to new knowledge creation should be easiest for those at the centre of a trust network.

Trusting relationships are governed by principles of social exchange (a person provides a favour with an expectation of the other party repaying the favour in future) (Blau, 1964). When a person trusts a co-worker, s/he is more willing to disclose tacit knowledge and critical information, accepting the risk that the co-worker might not return the favour or may utilise the knowledge and information only for his or her own sake. When a co-worker is trusted, one more easily accepts criticisms and other costs associated with maintaining the relationship; because when trust is present, one has more confidence that investments in the relationship will reap adequate returns in the longer term (Dirks & Ferrin, 2001).

A major goal of knowledge-intensive teamwork is making new discoveries. The tacit and confidential knowledge and information acquired through trust-based relationships may increase the stock of knowledge available to the trustee, and such knowledge is the basis for new knowledge creation. When the knowledge and information obtained from trusted co-workers is integrated with existing knowledge and/or when it is radically combined in novel ways, new knowledge is created (McFadyen & Cannella, 2004; Nahapiet & Goshal, 1998; Tolstoy, 2009). By promoting knowledge sharing, co-worker trust promotes knowledge creation (Abrams et al., 2003; Tsai & Goshal, 1998; Yli-Renko et al., 2001).

Therefore, we proposed:

Hypothesis 1: Co-worker trust (the degree of which a person is trusted by teammates) is positively associated with the amount of new knowledge the person creates.

### **Task interdependence as a moderator of the relationship between co-worker trust and knowledge creation**

The behaviours of employees are constrained and facilitated by task requirements (Brown & Miller, 2000). Although no standard task typologies have been adopted in the existing management literature (Druskat & Kayes, 1999), task interdependence has been widely recognised as a task characteristic that influences employee attitudes and behaviours (for example, Campion, Papper, & Medsker, 1996; Gladstein, 1984). Employees who work on tasks that require interdependent actions must coordinate their actions in order to accomplish their tasks. As colleagues coordinate and cooperate to get work done, they exchange and acquire task-relevant information and resources (Gladstein, 1984). Hence, for knowledge-intensive tasks, task interdependence may represent the degree to which exchanging and acquiring task-relevant knowledge is an essential activity that contributes to knowledge sharing and subsequent performance (e.g. De Jong, Van der Vegt, & Molleman, 2007; Staples & Webster, 2008).

Trust is a resource that is likely to have greater value when tasks require high levels of interdependence, because individuals can acquire more tacit and critical knowledge through co-worker trust networks. High task interdependence may facilitate interpersonal interactions between team members (Gladstein, 1984), allowing individuals who are more trusted by co-workers to acquire critical knowledge and information more easily.

Being trusted by one's co-workers can facilitate one's ability to coordinate actions and smooths the way for making performance-enhancing adjustments in how work is

allocated and how tasks get done. As the interdependencies among team members increase, so, too, do the demands on team members to coordinate their activities and make mutual adjustments (Thompson, 1967). Team members who are trusted by others are likely to be more effective in their attempts to influence others to make needed adjustments. When trust is low, however, coordination is more difficult and co-workers may be less willing to make adjustments for the benefit of a co-worker. Accordingly, a person who is not highly trusted is less likely to perform effectively on tasks that involve high degrees of interdependence.

When working on tasks that require higher amounts of interdependence, team members who are highly trusted by other team members may easily obtain, combine and exchange knowledge and information, and these activities are precursors to knowledge creation. In particular, in the context of high task interdependence, co-workers are more likely to share work-related knowledge and information with a team member whom they trust. In addition, when tasks are highly interdependent, team members with greater co-worker trust will have contacts with different co-workers and therefore they are more likely to have diverse knowledge and information. Thus, when tasks are highly interdependent, team members who are highly trusted by co-workers may gain more access to diverse and work-related knowledge and information. In contrast, when task interdependence is lower, the value of trust is also likely to be lower. When team members work more independently, trust plays a less significant role in knowledge creation. Thus, following this logic, we proposed:

Hypothesis 2: Task interdependence will moderate the positive relationship between co-worker trust and knowledge creation such that this relationship will be stronger for individuals working on team tasks characterized by greater interdependence.

## Methods

### *Procedure and sample*

We collected data from biology and chemistry research teams in a university located in the eastern United States. Interviews with science professors, post-doctoral assistants and doctoral students confirmed that many characteristics of research teams working in university science laboratories are similar to those of corporate research teams. Team members often interact with one another to learn and develop new research methods, conduct experiments and share resources. In addition to the work they do in their own laboratories, science team members also engage in external networking to obtain information and knowledge. In the typical science research laboratory, a professor or laboratory head acts as a manager of the team. This person hires employees (e.g. research professors, research associates, technicians, post-docs, doctoral students and master's students), determines their compensation, is held accountable for acquiring the financial and other resources needed to operate the laboratory and complete the work, and is, in turn, evaluated based on the performance of the entire science team.

Seventy laboratory teams with a total of 350 team members agreed to participate in the study. Following Sparrowe, Liden, Wayne, and Kraimer's (2001) suggestion, teams with less than 80% response rates were excluded in order to ensure accurate assessments of network characteristics at the team level, resulting in a final sample of 48 teams with a total of 194 team members.

## Measures

### *Co-worker trust*

We used a sociometric survey to assess trust networks. We relied on the science research laboratory heads to define the team by providing a roster of team member names. This roster of names was presented to the team members during data collection to define the boundary of the team. To ensure the anonymity of study participants, we asked respondents to use the roster to fill in the first and last name initials of team members and use these initials as referents when completing the sociometric survey. For each co-worker, respondents provided ratings of their feelings of trust using a four-point Likert-type response scale ranging from 1 (to a great extent) to 4 (not at all). Following Burt (1992) and Sparrowe et al. (2001), trust ratings indicated: 'How much do you trust each person?' We first recoded the reversely coded scale from 1 (not at all) to 4 (to a great extent). Using these ratings, we calculated in-degree trust network centrality (Brass, 1995; Lau & Liden, 2008) to measure co-worker trust. In-degree centrality is typically defined as the number of incoming links from other people when the trusting relationship is measured a dichotomous value (1 = the existence of trusting relationship, 0 = no trusting relationship) (Brass, 1995). However, we used a four-level scale, which can capture the trusting relationships more accurately. Following Lau and Liden (2008), we calculated in-degree centrality as the average degree of trust that teammates reported for the focal employee.

### *Knowledge creation*

To assess knowledge creation, we calculated each team member's publication impact using publication lists that they provided. Following McFadyen and Cannella (2004) and Stephan and Levin (1991), we obtained the Institute of Scientific Information's (ISI) impact factor scores for all publications. ISI scores adjust for the frequency of publication issues, the volume of journals, and the history of journals. To create an impact score for each individual, we calculated a weighted impact score. For example, a team member with two publications in Journal A with an impact score of 4 and one in Journal B with an impact score of 1 would be assigned a weighted impact score of  $[(2 \times 4) + (1 \times 1)] = 9$ . In comparison to the self-reported creativity measures used in most prior research (e.g. Hirst, van Kippenberg, & Zhou, 2009), the advantage of the measure we used is that it is a more objective indicator of actual knowledge creation.

### *Task interdependence*

Thompson (1967) and Van de Ven, Delbecq, and Koenig (1976) proposed a four-level hierarchy of task interdependence: pooled interdependence, sequential interdependence, reciprocal interdependence and team interdependence (or simultaneous, multidirectional workflow). *Pooled interdependence* is the lowest level of task interdependence; it refers to a task structure where each team member works individually without direct interactions among team members. *Sequential interdependence* is a task structure where each team member works individually but must perform his or her task after another completes a task; the degree of interdependency required is slightly greater because each person must wait for input from others before performing

his or her own task. Under sequential interdependence, each team member must perform a part of the overall project in a successive order. *Reciprocal interdependence* is a task structure where team members perform individually, in general, but the tasks nevertheless require some temporarily lagged and two-way interactions (Saavedra et al., 1993). *Team interdependence* is the highest level of task interdependence; it requires that all team members work together simultaneously and make job-related decisions collectively to complete a project. As Thompson (1967) and Van de Ven et al. (1976) argued, the four types of task interdependence are not different constructs but one construct that varies in degree only. We asked team leaders to indicate the degree of task interdependence required by the team task using schematic diagrams that depicted four forms of workflow, following Van de Ven and Ferry (1980). The original diagrams described the flow of work within business units. To adapt these diagrams for our study, we modified them to refer specifically to the tasks carried out in the teams we studied. As Thompson (1967) suggested, task interdependence was assessed using a Guttman scale (1 = ‘almost none of the work’, 5 = ‘almost all of the work’). The Appendix illustrates the measure we used to assess task interdependence.

### Controls

We included several control variables in our analyses, including demographic attributes (sex, age, race), individual human capital (education level and tenure), individual external networks (external network size, external informational network strength, external network diversity) and team size.

To assess demographic attributes, which might be associated with both performance and trust, we obtained self reports of gender (0 = male; 1 = female), race (0 = non-white; 1 = white), and age.

We also included measures of human capital as controls, because prior research has found that being trusted can be significantly influenced by a trustee’s abilities (for a meta-analytic review, see Colquitt et al., 2007), and knowledge creation is also associated with individual abilities (McFadyen & Cannella, 2004). To control for the individual human capital, we included measures of education level (0 = doctoral degree; 1 = no doctoral degree) and job tenure.

To take into account the influence of external networks on knowledge creation, we controlled for several aspects of individual external networks, including external informational network size, external informational network strength, and external informational network diversity. External informational networks may help team members to acquire various and novel knowledge (Hansen, 2002). Outside connections may provide individuals with a variety of possibilities and alternatives on which to draw when engaging in problem-solving activities and may stimulate the creativity related cognitive processes (Perry-Smith, 2006) involved in creating new knowledge. We used egocentric network data to measure external networks. First, respondents listed the first- and last-name initials of up to eight people in the organisation who they considered to have been valuable contacts for obtaining work-related information. We did not ask team members to indicate people in their informational network who were not members of the organisation, because lab leaders and members reported during pilot interviews that most team members focused on job-related networks within the organisation (lab leaders, however, frequently had networks that extended beyond the organisation). For each external contact listed, respondents provided ratings to answer the question: ‘How close is

your work-related relationship (e.g. collaborating on tasks, exchanging job-related information) with each person?’ using a four-point Likert-type response scale ranging from 1 (not at all) to 4 (to a great extent). Limiting the list of possible contacts may not have allowed all members to describe their entire external network, but constraining the number of contacts listed has the benefit of making data collection more feasible (see Morrison, 2002). Only 6% of respondents listed the maximum allowed number of external contacts, suggesting that placing a limit of eight contacts did not substantially restrict variation among respondents. Following Hansen, Podolny, and Pfeffer (2001), *external informational network size* was measured as the number of external informational network ties that a team member has. *External informational network strength* was operationalised as the sum of all network external tie ratings divided by the number of external informational relationships reported. *External informational network diversity* was assessed using Blau’s heterogeneity index; it reflects the extent to which people in one’s external network worked in different departments.

## Results

### *Descriptive statistics*

Table 1 reports means, standard deviations and bivariate correlations for all the variables in the model. As expected, knowledge creation was positively associated with external informational network size, strength and diversity. In addition, individuals who have a Ph.D. degree and have longer tenure are more likely to create new knowledge. However, the correlation of co-worker trust with knowledge creation was not significant.

### *Tests of hypotheses*

We used Hierarchical Linear Modeling (HLM) analyses to test the hypotheses. Table 2 reports the results of the HLM analyses. First, we entered only the dependent variable to test the null model. The null model for creation of new knowledge revealed a significant team-level effect ( $\gamma = 4.93$ ,  $p < 0.01$ ), meaning that there was significant between-team variation in the creation of new knowledge. This finding supports our assumption that some team-level variables are relevant to explaining variance in individual-level knowledge creation, and is a necessary result that enables us to test our cross-level model. Next, we tested for the effects of all control variables on new knowledge creation. Individuals who held a Ph.D. degree, who had worked in the lab for a long time and who had diverse external informational networks were more likely to create new knowledge. The results support our decision to include this indicator of human capital as a control variable.

Model 1 in Table 2 reports the results of the analyses used to test Hypothesis 1, which predicted a positive relationship between co-worker trust and knowledge creation ( $\gamma = 13.37$ ,  $p < 0.05$ ), supporting Hypothesis 1. As expected, researchers who were more strongly trusted by co-workers also created more knowledge, and this effect was significant even after controlling for characteristics of their external networks.

Following Aiken and West (1991), we tested the cross-level moderating effect of task interdependence, predicted by Hypothesis 2, by regressing new knowledge

Table 1. Descriptive statistics and intercorrelations.

Variables	M	SD	1	2	3	4	5	6	7	8	9
Level 1 (individual)											
Knowledge creation	4.82	8.94									
Sex	0.47	0.50	.09								
Age	31.04	7.30	.29**	.03							
Race	0.40	0.49	-.04	-.06	-.23**						
Job tenure	3.19	2.90	.25**	-.17*	.74**	-.06					
Education level (reverse scored)	0.61	0.49	-.39**	-.04	-.58**	.11	-.29**				
Co-worker trust	0.13	0.10	.10	-.06	-.01	-.05	-.11	.05			
External informational network size	3.37	2.31	.21**	-.05	.09	.13	.04	-.08	.15*		
External informational network strength	0.40	0.20	.15*	.09	-.07	.06	-.17*	-.01	-.05	.28**	
External informational network diversity	0.37	0.37	.23**	.09	-.10	.04	-.13	-.13	-.07	.29**	.28**
Level 2 (team)											
			<i>II</i>								
Team size	4.13	1.18									
Task interdependence	1.29	0.36	-.02								

Note:  $N = 194$  (level 1) and 48 (level 2), \*\*  $p < 0.01$ . \*  $p < 0.05$ . †  $p < 0.10$ . Two-tailed.

Table 2. Hierarchical linear modelling analysis on knowledge creation.

Predictors	Null model		Model 1		Model 3	
	Controls		H1	Model 2	H2	
Intercept	4.93**	7.23**	7.09**	6.95**	6.88**	
<i>Level 1 (individual)</i>						
Sex		1.83	2.19†	2.59*	2.45*	
Age		-0.11	-0.14	-0.14	-0.16	
Race		0.01	0.11	-0.24	-0.34	
Job tenure		0.85*	0.97**	0.92**	0.93*	
Education level (reverse scored)		-5.14**	-5.43**	-5.20**	-5.06**	
External informational network size		0.62*	0.54†	0.50†	0.48**	
External informational network strength		3.91	4.66	4.48	4.43*	
External informational network diversity		3.79*	3.84*	3.83*	3.71**	
Co-worker trust			13.37*	12.15*	7.73	
<i>Level 2 (team)</i>						
Team size		-0.50	-0.21	-0.30	-0.33	
Task interdependence				4.26*	4.44**	
<i>Cross-level interactions</i>						
Co-worker trust × task interdependence					27.56*	
<i>Model deviance</i>						
	1389.52	1328.73	1316.47	1310.29	1298.42	
<i>Variance estimates</i>						
Level 1 residual variance ( $\sigma^2$ )	67.28	54.47	53.38	53.36	52.90	
Level 2 residual intercept variance ( $t_{00}$ )	12.56	8.86	8.52	6.63	6.62	
Level 2 residual variance in slope ( $t_{11}$ )				75.37†	68.09*	
<i>Pseudo R<sup>2</sup></i>						
$R^2_{\text{level } 1}$ <sup>a</sup>		0.19	0.21	0.21	0.21	
$R^2_{\text{level } 2}$ for intercept <sup>b</sup>		0.29	0.32	0.47	0.47	
$R^2_{\text{level } 2}$ for slope <sup>c</sup>					0.10	

Note:  $N = 194$  (level 1) and 48 (level 2), entries corresponding to the predicting variables are estimations of the fixed effects, gammas, with robust standard errors. All continuous variables were grand-mean centred. \*\*  $p < 0.01$ . \*  $p < 0.05$ . †  $p < 0.10$ . Two-tailed. <sup>a</sup>  $R^2_{\text{level } 1} = (\sigma^2 \text{ of null model} - \sigma^2 \text{ of current model}) / \sigma^2 \text{ of null model}$ . <sup>b</sup>  $R^2_{\text{level } 2} = (\tau_{00} \text{ of null model} - \tau_{00} \text{ of current model}) / \tau_{00} \text{ of null model}$ . <sup>c</sup>  $R^2_{\text{level } 2}$  for the slope ( $\tau_{11}$  of Model 2 -  $\tau_{11}$  of model 3) /  $\tau_{11}$  of model 2.

creation on co-worker trust times task interdependence, controlling for all other variables. The result indicated that task interdependence significantly affected the relationship between co-worker trust and knowledge creation (Model 3; Figure 2:  $\gamma = 27.56$ ,  $p < 0.05$ ). As predicted and shown in Figure 2, for tasks requiring greater interdependence, the relationship between co-worker trust and knowledge creation was stronger than for tasks requiring less interdependence.

## Discussion

Knowledge creation is an essential activity for ensuring organisational success in knowledge-intensive industries, and it is a primary goal of research scientists (McFadyen et al., 2009). A large body of research suggests that acquiring relevant resources (e.g., abilities) and establishing the appropriate conditions for knowledge transfer (establishing strong networks) contributes to the creation of new knowledge, which in turn should contribute to an organisation's success in gaining a competitive advantage (Jackson et al., 2006; McFadyen & Cannella, 2004; Nahapiet & Ghoshal,

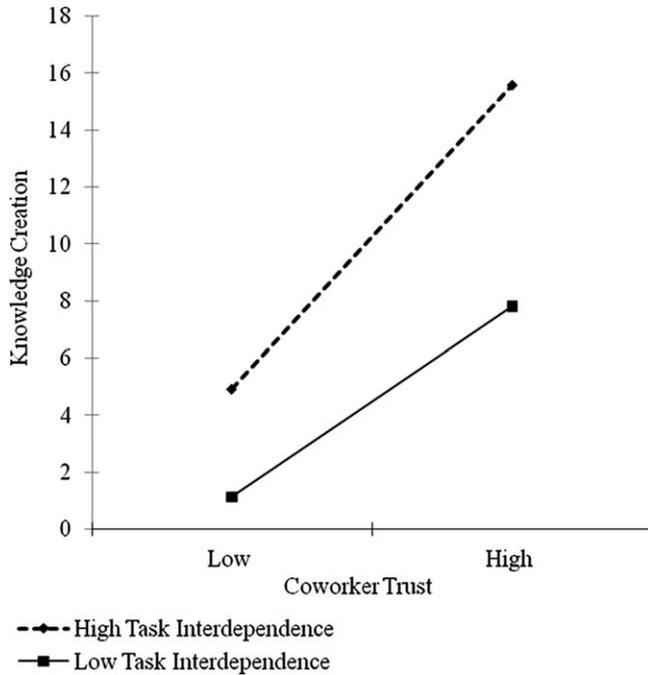


Figure 2. Task interdependence as a moderator of the relationship between co-worker trust and knowledge creation.

1998; Tsai & Ghoshal, 1998). Among the many factors that are likely to influence knowledge creation, trust from co-workers has been identified as among the most important (Coleman, 1988; Nahapiet & Ghoshal, 1998). The results of this study confirmed our prediction that an individual scientist's success in creating new knowledge is enhanced when co-workers trust the scientist. Furthermore, the value of such co-worker trust appears to be greater for scientists working in research labs that require the highest degrees of collaboration – that is, in labs where the work is characterised by high task interdependence.

These results advance our understanding of the role of co-worker trust in new knowledge creation. Previous studies have mainly investigated trust in leaders and there are fewer investigations of trust from co-workers (Ferrin et al., 2006; Lau & Liden, 2008; Sparrowe & Liden, 2005). In addition, there has been relatively little research investigating the consequences for individual knowledge workers of being trusted (for exceptions, McFadyen & Cannella, 2004, 2005). Our results provide support for prior theoretical arguments about the benefits of being trusted, especially for employees working in knowledge-intensive teams.

To understand the conditions under which co-worker trust contributes to knowledge creation, we examined the moderating roles of a core contextual factor: task interdependence. Although task interdependence has long been recognised as a critical contextual factor that may affect how interpersonal relations influence performance (Gladstein, 1984), we found no prior studies examining the moderating role of task interdependence on the relationship between co-worker trust and knowledge creation. Our results revealed a stronger positive relationship between co-worker trust and knowledge creation for research scientists working on tasks that

involved high levels of interdependence, compared to those working on similar tasks that involved less interdependence. For knowledge-intensive tasks such as those that are at the heart of scientific research, trusting relationships between team members were expected to ease the flow of information. In the context of high task interdependence, team members who are trusted by co-workers may have greater access to information. Also, they may be able more readily to use available information and knowledge to create new knowledge through more effective collaborations with others. To date, the potential role of the task context has been largely ignored in the theoretical and empirical literature on trust and knowledge creation. Our results indicate that the value of trust may depend partly on the nature of work performed by knowledge workers. Even among employees working on somewhat similar tasks, the performance benefits of being trusted by co-workers apparently increases to the extent that the work requires greater degrees of interdependence.

The multi-level structure of our data set and the application of HLM analysis techniques allowed us to test rigorously the relationship between co-worker trust and individual knowledge creation across a variety of team contexts. Although the importance of cross-level phenomena has been recognised by other scholars, prior research on trust has been limited by reliance on studies that focus on a single level of analysis (Schoorman et al., 2007). By studying individuals embedded within research teams, grounding our data collection and analysis in network analysis techniques, assessing characteristics of the work task, and controlling for several additional individual- and team-level factors, we were better able to capture the multilevel complexities of knowledge work.

Our results also contribute to the growing literature on the role of external informational networks as factors that contribute to new knowledge creation. Although our study was designed to focus on trust from co-workers within one's work team, we included some measures of the external networks of the research scientists who participated. Our results indicate that external informational network size and diversity contributed to individual knowledge creation. The result provides additional evidence of the importance of external boundary spanning as a role that contributes to new knowledge creation (Gladstein, 1984; Joshi, Pandey, & Han, 2009).

### ***Limitations and future research***

Although this is one of the first empirical studies to shed light on the relationship between co-worker trust and new knowledge creation, it has some limitations that must be acknowledged. One limitation concerns the question of causality. We argued that co-worker trust shapes knowledge creation, but it is likely that the relationship between co-worker trust and knowledge creation is reciprocal. Team members who are trusted by co-workers may tend to create more new knowledge. At the same time, however, it is possible that highly productive team members are more likely to be attractive to and trusted by their co-workers. Co-workers may assume that highly productive co-workers possess superior ability and are also more trustworthy (Colquitt et al., 2007; Mayer et al., 1995). To minimise the causal ambiguity that is inherent in our methods, we controlled for human capital variables (education level and tenure) that were likely to be associated with prior knowledge creation. In

addition, we excluded respondents who joined the team less than six months prior to data collection, in order to reduce the possible influence of knowledge creation that had occurred before a person joined the work team and before co-workers had time to develop authentic co-worker trust. Nevertheless, the design of our study yielded essentially cross-sectional data and we are not able to draw strong conclusions about causality. In order to address this issue, research that examines changes in co-worker trust and new knowledge creation over time would be useful.

Another limitation is that we used a single item measure to capture the degree of trust from each co-worker in the work team, as others have done (e.g., Lau & Liden, 2008; Sparrowe & Liden, 2005). By assessing trust from each member of the team, we are confident that our measure of co-worker trust was reliable. However, the measure we used did not permit us to assess the multidimensionality of trust. Trust of different types – such as cognitive-based or instrumental trust and affect-based or emotional trust (see for a review, Chua, Ingram, & Morris, 2008) – may have different consequences for knowledge-based activities. Future research that examines the multiple dimensions of trusting relationships and behaviours is needed to enhance further understanding of co-worker trust (Gillespie, 2003) and may provide additional insights about how co-worker trust contributes to knowledge creation.

Another limitation is associated with the theoretical definition of trust. Following Mayer et al. (1995) and Rousseau et al. (1998), we defined trust as a trustor's willingness to be vulnerable to a trustee. According to this definition, trust is an attitude that eventually influences risk-taking behaviours or trusting behaviours (Mayer et al., 1995). However, in order for a trustor's trusting attitude to influence trusting behaviours, the trustor must also make a decision to engage in trusting behaviour (Currall & Judge, 1995). Future research that examines both trust as an attitude and trust as a decision to engage in trusting behaviour may yield additional insights concerning these relationships.<sup>1</sup>

Another possible concern is that the relationship between co-worker trust and knowledge creation might be curvilinear. McFadyen and Cannella (2004) and Molina-Morales and Martínez-Fernández (2009) found that strength of social network ties had an inverted U-shape relationship with knowledge creation/innovation. They argued that in overly strong networks, the bonds between people can be debilitating because they constrain the breadth of views expressed by team members and thereby hamper knowledge creation activities. To check for this possibility, we tested for curvilinear relationships, but we found no significant effects. Thus, this possible concern is not problematic.

As in all research, measurement quality is another possible limitation. One could question whether our measure of knowledge creation reflects individual-level performance, rather than the performance of the entire team. Our interviews with lab leaders and team members clearly indicated that not all team members were involved in every project published by members of a team; team members typically earned authorship only if they directly and significantly contributed to a project. The majority of scientists in our sample did not share co-authorship on the publications used to measure knowledge creation in this study.

Finally, we note that we measured co-worker trust from team members only, and did not assess trust from other colleagues outside the team. We did, however, control for several external network characteristics, including the size, strength and diversity of

the target person's external informational network. As Table 2 reveals, consistent with prior research on boundary spanning and external networks (e.g., see Joshi et al., 2009), external informational network size and diversity were associated with knowledge creation. Additional research is needed to determine whether the effects we observed for co-worker trust also apply when examining trust from colleagues outside one's immediate work team.

### ***Practical implications***

Our results suggest that organisations can improve performance on knowledge creation tasks by supporting the development of strong interpersonal trust among teammates. Specifically, we found that team members who are more trusted by co-workers are more likely to produce new knowledge. This relationship was stronger for individuals working on tasks that involved high degrees of task interdependence. A practical implication of this result is that organisations should adopt management practices that are likely to enhance trust between co-workers in knowledge-based environments, especially when the work requires high degrees of interdependence. By providing socialisation practices and creating a cooperative climate, organisations can provide opportunities for employees to get to know one another and build trust. In addition, organisational efforts such as employment stability, decentralised work structures and employee involvement programmes may enhance interpersonal trust by establishing a cooperative and collaborative organisational climate that supports the development of stable, long-term relationships within an organisation (Leana & Van Buren III, 1999).

Another way to increase co-worker trust within the organisation is through appropriate recruitment and selection practices. A recent meta-analysis found that ability, integrity, and benevolence are strong and proximal predictors to being trusted by co-workers (Colquitt et al., 2007). Accordingly, organisations may find it is effective to implement recruitment and selection procedures to ensure that they hire employees with these attributes. Training programmes that emphasise the importance of benevolence and integrity among teammates may also be effective (Colquitt et al., 2007).

Our results suggest that investing in the development of trust networks may prove to be particularly beneficial for teams working on tasks that require intensive collaboration and mutual interdependencies. Investing in the development of strong trust networks may be a misuse of valuable resources under some conditions. Specifically, even for teams working on knowledge-intensive tasks, the value of trust in contributing to performance may be relatively low if team members can accomplish their work without intensive collaboration. Thus, in addition to efforts aimed directly at building trust among team members, organisations may find it useful to provide training to leaders as a way to increase their awareness of the importance of co-worker trust among knowledge workers. Recognising and rewarding team leaders who successfully create conditions that allow trust to flourish may be one useful approach.

### **Note**

1. We thank the Action Editor, Peter Ping Li, for suggesting the value of differentiating trust as an attitude from trust as a decision.

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### Appendix A: Measure of task interdependence used in this study

Team leaders described the amount of task interdependence required for the team task by answering four questions using a Guttman scale. For each diagram, leaders responded to the question, *How much work normally flows among your lab members in this manner?* Responses were made using the following scale: 1 = almost none of the work, 2 = little, 3 = about 50% of all the work, 4 = a lot, 5 = almost all of the work. Answers were weighted by multiplying the lab leader's response to independent flow by zero, sequential flow by 0.33, reciprocal flow by 0.66, and team

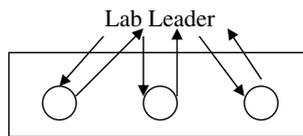
flow by one, then adding the products to obtain the overall work flow interdependence score (Van de Ven & Ferry, 1980, p. 166). The overall flow of task interdependence was divided by four.

### Instructions

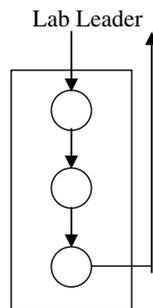
The next four questions are about the internal flow of work between your lab members. Listed and diagrammed below are four common ways that the work performed in your lab can flow among your lab members. (You, as the lab leader, should consider yourself outside the boxes below).

Please indicate how much of the normal work in your lab task flows among your lab members in a manner as described by each of the following cases:

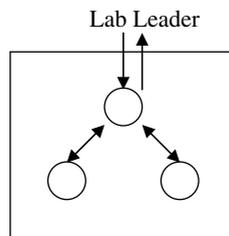
1. *Independent Work Flow Case*, where work and activities are performed by your lab members separately and do not flow between them?



2. *Sequential Work Flow Case*, where work and activities flow among team members, but mostly in only one direction?



3. *Reciprocal Work Flow Case*, where work and activities flow among lab leaders in a back-and-forth manner over a period of time?



4. *Team Work Flow Case*, where work and activities come into your lab and your lab members diagnose, problem solve, and collaborate as a group at the same time in meetings to deal with the work.

