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Phong Ba Le, Hui Lei,

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Determinants of innovation capability: the roles of transformational leadership, knowledge sharing and perceived organizational support

Phong Ba Le and Hui Lei

Abstract

Purpose – The study aims to explore the differences in transformational leadership's (TL's) influences on each aspect of innovation capability, namely, product innovation and process innovation. It also deepens understanding of the pathways and conditions to improve specific aspects of innovation capability by assessing the mediating role of knowledge sharing (KS) and moderating mechanism of perceived organizational support (POS).

Design/methodology/approach – The paper utilized structural equation modeling and cross-sectional design to test hypotheses in the proposed research model based on using data collected from 394 participants at 88 Chinese firms.

Findings – The findings indicate that KS mediates TL's effects on innovation capabilities. In addition, the influences of TL and KS on specific aspects of innovation capability are different and depend on the extent of employees' POS.

Research limitations/implications – Future studies should test mediating roles of knowledge management's constituents and/or investigate the moderating roles of firm ownership form to increase the understanding of potential factors or key conditions that may have significant influences on a firm's innovation capability.

Practical implications – The paper significantly contributes to increasing the understanding of the link between TL and specific aspects of innovation capability by highlighting the important role of stimulating KS and enhancing POS.

Originality/value – The paper provides useful information and valuable initiatives to increase leadership outcomes and firm's capability for innovation.

Keywords Innovation, Knowledge sharing, Transformational leadership, Product innovation, Process innovation, Perceived organizational support

Paper type Research paper



Phong Ba Le is based at the School of Business Administration, Hunan University, Changsha, Hunan, China, and Faculty of Business Management, Hanoi University of Industry, Bactuliem, Hanoi, Vietnam. Hui Lei is based at the School of Business Administration, Hunan University, Changsha, Hunan, China.

1. Introduction

The increasing changes of technology, customer needs, and global economic integration cause firms to face many difficulties and challenges (Jia *et al.*, 2018; Le and lei, 2018). Organizational innovation is emerging as a hot topic that attracted increasing attention from researchers and practitioners (Khalili, 2016; Prasad and Junni, 2016; Charterina *et al.*, 2017; Le and Lei, 2018; Tian *et al.*, 2018). Organization's innovation capability has been regarded as crucial means of achieving firm's competitive advantage and sustainable success (Colino *et al.*, 2014; Liao *et al.*, 2017; Le and Lei, 2018). Accordingly, many firms attempt to identify appropriate and effective pathways to successfully innovate but they are still imitators and are struggling to become innovators (Song, 2015; Le and Lei, 2018). Given

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this context, the identification of strategic factors that significantly promote firms' innovation capability becomes more and more meaningful and very necessary.

Leadership and knowledge sharing (KS) have widely recognized as the key sources for firms to foster innovation capability and attain organization's effectiveness, survival and sustainable competitive advantage (Choi *et al.*, 2016; Le and Lei, 2017; Ritala *et al.*, 2018). Prior studies supposed that leaders and their leadership behaviors are possibly the most important force of promoting innovation capability (Jung *et al.*, 2008; Jia *et al.*, 2018). Among different leadership styles, transformational leadership (TL) has been considered one of the most effective leadership styles (Le *et al.*, 2018). TL practice might be a decisive pathway to enhance firm's innovation capability (Prasad and Junni, 2016; Zheng *et al.*, 2016; Sattayaraksa and Boon-itt, 2018). TL positively involves firm's innovation capability through intellectual stimulation, encouraging openness among individuals (Vera and Crossan, 2004), inspiring and motivating employee's innovation behavior (Choi *et al.*, 2016). However, knowledge of the direct correlation between TL and innovation capability remains underdeveloped and insufficient. There still exist theoretical and empirical gaps in the TL–innovation relationship, which we need to continue exploring and studying (Choi *et al.*, 2016; Jia *et al.*, 2018), especially the relationship between TL and specific aspects of innovation (Anderson *et al.*, 2014). Consequently, this study is implemented not only to explore the differences in TL's influences on each aspect of innovation capability namely product innovation and process innovation but also to deepen understanding of the pathways and conditions to improve specific aspects of innovation capability by assessing the mediating role of KS and moderating mechanism of perceived organizational support (POS). The research topic is new, interesting and urgent for many reasons.

First, managing innovation and improving innovation capability are becoming one of the most important and interesting issues in the current literature (Breznik and Hisrich, 2014; Leavy, 2015; Prasad and Junni, 2016; Charterina *et al.*, 2017; Tian *et al.*, 2018). Although TL and KS are recognized as the drive of successful innovation (Barczak *et al.*, 2010; Paulsen *et al.*, 2013; Prasad and Junni, 2016), the literature on the relationship between these constructs is still incompetently (Choi *et al.*, 2016; Jia *et al.*, 2018). Moreover, the study by Choi *et al.* (2016) argued that KS is a key determinant in shaping an innovative organization, but the antecedents that encourage or discourage KS are poorly understood and studied. They suggested the need to study the mediating mechanism of KS between TL and innovation behaviors. So, by filling the research gap addressed above, the paper aims to provide deeper knowledge of the mediating role of KS in the relationship between TL and specific aspects of innovation capability.

Second, Anderson *et al.* (2014) emphasized the necessity of identifying the antecedents of specific facets of innovation by posing a question that:

Q1. What is the relationship between organizational resources and different types of organizational innovation?

Meanwhile, leadership characteristics and KS were regarded as some of the crucial organizational resource (Wang and Noe, 2010). Hence, exploring how different in the influences of TL and KS on each aspects of innovation capability namely product innovation and process innovation will significantly contributes to providing useful solutions or right pathway to attain each specific type of innovation capability.

Finally, according to Choi *et al.* (2016), previous studies did not have a consensus on the TL's positive influence on organizational innovation. They assumed that future research is necessity not only to confirm TL–innovation relationship but also to explore the moderating role of POS between them. Obviously, organizations with differences in their climate and supports may produce various impacts on KS and innovation due to the dissimilarity in providing sources, opportunities and motivations for these activities. Accordingly, these effects can hinder or promote TL's positive influences on KS and innovation capability. To

have more empirical evidence, deeper understanding and an integration view about a pathway led to specific aspect of innovation, the paper will investigate the moderating role of POS in the relationship between TL and KS and between TL and aspects of innovation capability

To fill the theoretical gaps addressed above, this study was done to elucidate some following research questions:

- RQ1.* How different are the influences of TL and KS on specific aspects of innovation capabilities?
- RQ2.* Does KS mediate TL's effects on innovation capabilities?
- RQ3.* Does POS moderate TL's effects on KS and innovation?

To provide answers for above research questions, this study applies structural equations modeling (SEM) to investigate the correlation between the structures in the research model based on the data collected from 394 participants in 88 manufacturing and service firms in China. Our study is expected to provide theoretical initiatives on organizational behavior and knowledge management as well as practical implication to improve innovation capabilities for firms.

2. Literature review and hypotheses development

2.1 The effect of transformational leadership on innovation capability

TL is perceived as one of the most effective leadership styles affected key outcomes of an organization such as: knowledge capital, human capital (Birasnav *et al.*, 2011), managerial performance (Nguyen *et al.*, 2017) and innovation performance (Jia *et al.*, 2018). Bass (1985, 1990) defined TL with four characteristics: idealized influence (ability to provide a vision and perception of mission, instilling pride, gaining respect and trust), intellectual stimulation (ability to promote intelligence, rationality and attentive problem-solving), inspirational motivation (interested in communicating high expectations, using symbols to focus efforts, expressing important purposes in simple ways) and individualized consideration (interested in personal attention, treating each employee individually, coaching and advising). The theory of TL has attracted much observation from scholars and emerged as one of the most powerful leadership theories (Mhatre and Riggio, 2014; Le and Lei, 2017). For that reason, investigating the relationship between TL and specific forms of innovation will have valuable contributions in the field of leadership and innovation management.

Innovation is a principal driver of economic development and plays a pivotal role in competition at both the national and firm levels (Hogan and Coote, 2014). Drucker (2014) defined innovation as the capabilities of creating new products, services, work processes, and management procedures to gain an organizational competitive advantage. Innovation capability is classified into various categories (Liao *et al.*, 2007; Podrug *et al.*, 2017) among which product innovation and process innovation are recognized as two fundamental types (Tsai *et al.*, 2001) or two critical capabilities of innovation in complex and rapidly changing business environments (Tsai *et al.*, 2001; Lee *et al.*, 2013). As a result, this study focuses on investigating the influences of related variables on these two aspects of innovation. According to Tsai *et al.* (2001), product innovation refers to an organization's capability of providing differentiated or new products/services in the market to acquire customers' satisfaction. While, process innovation refers to organization's capability of providing a better process than current operation to get better performance.

Based on literature review, the authors argued that transformational leaders' characteristics are the main forces that directly or indirectly affect innovation capability, specifically:

- by means of idealized influence, TL will be able to persuade and motivate employees about the need for implement change and innovation. This also ensures that employee will support and have positive reaction to innovation efforts stemmed from their transformational leaders (Prasad and Junni, 2016);
- by transmitting inspirational motivation, transformational leaders foster employees' enthusiasm to fulfill their duties and organizational goals beyond the expectation (Bass, 1999; Prasad and Junni, 2016; Le *et al.*, 2018).

Thus, by emphasizing the necessity of improving innovation capability as an organization's strategic goal, TL can motivate employees to be more proactive and creative to enhance and develop new ideas and solutions related to firm's product and process. Third, by focusing on intellectual stimulation, transformational leaders increase employees' motivation and ability to think out of the box (Wilson-Evered *et al.*, 2004) which brings a high degree of vision to the organization, and employees become more ready to commit in accomplishing the vision effectively (Felfe and Goihl, 2002; Choi *et al.*, 2016). Thus, TL can encourage and challenge employees to innovate and improve current products, processes, and organizational structures to meet goals and organizational vision. Finally, through individualized consideration, transformational leaders facilitate to develop employees' capabilities (Bass *et al.*, 2003), and bring them learning opportunities that is the main sources of building employee's creative thinking (Prasad and Junni, 2016). Moreover, by handling employees' personal needs, TL cultivates the supportive climate for innovative behaviors such as self-efficacy, experiment and be creative (Gumusluoglu and Ilsev, 2009; Prasad and Junni, 2016).

Transformational leaders play a dominant role in generating innovation by creating and shaping a positive climate for encouraging the abilities and practices to promote innovation capability. Indeed, many works in the growing literature on TL have appointed out a positive relationship between TL and innovation (Jung *et al.*, 2003; García-Morales *et al.*, 2012; Trung *et al.*, 2014; Choi *et al.*, 2016; Prasad and Junni, 2016). For example, according to Jung *et al.* (2003), TL is positively associated with innovation capability based on encouraging employees freely in discussing and trying out innovative ideas and approaches. García-Morales *et al.* (2012) pointed out that TL's behavior directly or indirectly influence firm's innovation capability through improving learning capability of a firm. Trung *et al.* (2014) showed that TL plays an important role in generating a climate in the organization that favors experimentation and the introduction of new ideas, processes, procedures or structures. The works by Choi *et al.* (2016), and Prasad and Junni (2016) showed the evidence that, TL is positive associated with employees' innovative behaviors and organizational innovation. Recently, Jia *et al.* (2018) also reported that TL directly or indirectly influences organizational innovation performance via openness of innovation.

Above arguments support positive correlation between TL and innovation capability, however empirical evidence on the relationship between TL and two specifics aspects of innovation capabilities namely product innovation and process innovation is still limited. To investigate clearer the relationship among these constructs, we proposed following hypothesis:

H1a. TL is positively related to product innovation.

H1b. TL is positively related to process innovation.

2.2 Knowledge sharing mediates the relationship between transformational leadership and innovation capability

Knowledge and knowledge management capability are crucial premise for success in most organizations (Carneiro, 2000; Lee *et al.*, 2016; Le and lei, 2017). Accordingly, strengthening firm's abilities to identify, collect, share, apply knowledge and turn such

knowledge capital into reality in firms' outcomes is very important. KS plays a decisive role in the process of knowledge management (Pee and Min, 2017; Wu and Lee, 2017; Le et al., 2018). The successful extent of initiatives of knowledge management mainly depends on the effectiveness of KS activities in an organization (Le and lei, 2017). KS helps to maximize a firm's ability to manage knowledge and allows individuals in organization to work and achieve goals more efficiently (Le and Lei, 2017). KS is defined as the process of interchanging knowledge and experience among individuals that helps individuals to equip and complement new and valuable knowledge/skills for each other to achieve both personal and organizational goals (Van den Hooff and De Ridder, 2004; Liao et al., 2007; Lin, 2008).

Leadership behaviors and characteristics have considerable influences on promoting or restricting employees' KS behaviors. The supports of leadership are essential for creating and maintaining a positive KS climate among employees in an organization (Lin and Lee, 2004). Numerous studies demonstrated that TL creates a supportive working climate and provides sufficient resources that facilitate KS activities among employees (Bass, 1999; Bass and Avolio, 2000; Birasnav et al., 2011; Choi et al., 2016; Masa'deh et al., 2016; Xiao et al., 2017; Le et al., 2018). For example, Bass (1999), and Bass and Avolio (2000) supposed that transformational leaders' features (such as charisma, inspirational motivation, and intellectual stimulation) positively encourage employees communicating and sharing knowledge with each other. In a similar vein, Xiao et al., (2017) argued that the TL's dimensions (charisma, intellectual stimulation and individualized consideration) are very suitable for managing knowledge. Under the organizational climate created by TL, employees become more creative and willing to share their personal knowledge capital with colleagues. The research by Birasnav et al. (2011) indicated that TL pays much attention on building a knowledgeable and supportive culture to shape and encourage employees' positive behavior toward KS. According to Masa'deh et al. (2016), by focusing on promoting employees' intellectual capital, providing vision and a sense of mission, and obtaining followers' respect and trust, TL practice is a key to create a positive atmosphere for KS. Le and Lei (2017) highlighted that TL directly and indirectly affects employees' behaviors toward KS through its positive impact on justice and employee trust in leadership. Recently Le et al. (2018) claimed that TL is one of the most appropriate leadership styles that encourage employees to participate in KS process.

Following the above-mentioned discussion, we hypothesize:

H2. TL significantly correlates KS.

With regard to the relationship between KS and innovation capability, it is clearly that, capability in transforming and applying knowledge determines a firm's degree of innovation, for instance, faster problem-solving and quick response to the changes of business environment. The significance and value of KS in supporting and enhancing innovation capabilities are also emphasized by previous research. Jantunen (2005) contended that KS behaviors among employees may help firms to have superior innovation capability. Liao et al. (2007) showed in their empirical study that KS has significant positive influences on both product innovation and process innovation in Taiwan's knowledge-intensive industries. Wang and Wang (2012) supposed that innovation initiatives mostly arise from the process of sharing knowledge, experience, and skill and firm's capability to transform and apply knowledge may decide its level of innovation capability. Sáenz et al. (2012) demonstrated that the employees' KS mechanisms (such as communities of practice, coaching and/or mentoring, and employee functional rotation) are the key means of increasing and exerting a positive influence on innovation capability in Spanish and Colombian high-tech firms. Lee et al.'s (2013) research from 162 manufacturing firms in Malaysia provided empirical evidence that KS is positively and significantly related to product and process innovation. According to Choi et al. (2016), by sharing task-related skills and expertise with colleagues, employee's KS process will create a lot of opportunities

to generate new ideas and enhance firm's innovation capabilities. Wang *et al.*'s (2017) research on the relationship between KS and individual innovation behaviour has also indicated that by sharing knowledge, employees can learn and combine again all kinds of knowledge, accordingly they may be more capable in translating new ideas into innovations. Recently, Le and Lei (2018) pointed out that by means of KS in organizational learning application, Chinese firms can benefit from collective knowledge and significantly affect innovation capabilities (such as innovation speed and innovation quality) and competitive advantage.

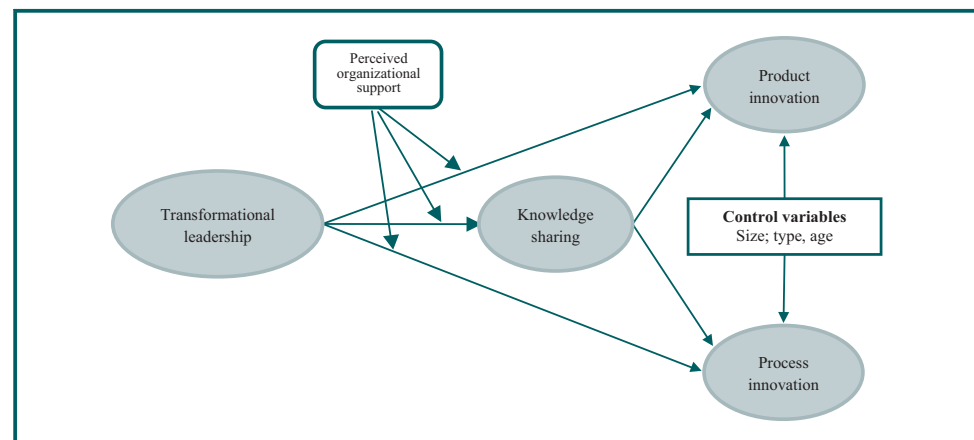
Although positive correlation between KS and innovation capability is verified, empirical studies on how KS connects with different aspects of innovation are still poorly (Anderson *et al.*, 2014; Le and Lei, 2018). The following hypothesis is therefore proposed to examine KS's impacts on product innovation and process innovation:

H3a. KS will be positively related to product innovation.

H3b. KS will be positively related to process innovation.

The current literature provides the evidence that TL is the important antecedents to foster individuals sharing their key knowledge (Choi *et al.*, 2016; Xiao *et al.*, 2017; Le *et al.*, 2018), which is the source and basic driver of improving firm's innovation capability (Wu *et al.*, 2016; Wang *et al.*, 2017; Le and lei, 2017). In addition, Choi *et al.* (2016) indicated that firm's ability to acquire and apply knowledge plays mediating role in the relationship between TL and innovation behavior. There is the fact that, the success of KS is depended on the individuals' willingness to share knowledge, but employees often delay or hesitate to share their key knowledge owing to fear of losing of knowledge ownership (Kankanhalli *et al.*, 2005; Alsharo *et al.*, 2017). To overcome and address these challenges, TL has a decisive role. Transformational leaders can create an openness, collaboration and atmosphere of trust among employee which, in turn, positively stimulate employees to share more key information, knowledge, and resources which are the important basis and prerequisite for increasing firms' innovation capabilities (Donate and Guadamillas, 2011; Le and Lei, 2018; Yang *et al.*, 2018). However, empirical evidence and the mechanism of how KS mediates the relationship between TL and innovation capabilities are not sufficient (Donate and Guadamillas, 2011; Anderson *et al.*, 2014; Choi *et al.*, 2016). Thus, investigating the mediating role of KS between TL and specific aspects of innovation is very needful in increasing the understanding and effective pathway to stimulate each aspects of innovation capability. Therefore following hypotheses are posed (see Figure 1):

Figure 1 Research framework



H4a. KS acts as a mediator between TL and product innovation.

H4b. KS acts as a mediator between TL and process innovation.

2.3 Perceived organizational support moderates transformational leadership's effects on knowledge sharing and innovation

Rhoades and Eisenberger (2002) considered POS as the organization's contribution to a positive reciprocity with employees, as they tend to act better to pay back the organization's positive effects. According to Eisenberger *et al.* (1986), when employees perceived that they are valued and supported by their organization, they will believe in organization values and attempt their best for organization's success. Choi *et al.* (2016) argued that if employees perceived to be treated fairly, they will reciprocate with high job performance and positive attitudes toward job and organization. Based on above argument, we define that POS reflects employees' best efforts in performing personal duties and organizational goals as a positive response that originates from their belief of being valued, being cared for well-being and having significant supports of organization.

POS is regarded as a crucial factor to generate a supportive climate or/and provide sufficient and necessary resources for KS activities (Mary MacNeil, 2004; Lin, 2007; Raab *et al.*, 2014), and for innovation activities (Zhou and George, 2001; Appu and Kumar Sia, 2015; Choi *et al.*, 2016; Suifan *et al.*, 2018). Regarding the impact of POS on KS, Mary MacNeil (2004) underlined the importance of the leader and organization's support to KS atmosphere in an organization. In line with this point of view, Lin (2007) indicated that management support positively affects employee willingness to share knowledge and skill with colleagues. Raab *et al.* (2014) suggested that purposeful and significant supports of leadership will encourage the value of social integration and trust on the KS process of employees.

Previous studies have shown POS is significance in moderating and mediating organizational relationships (Mahmoud, 2008; Choi *et al.*, 2016; Cheng and Yi, 2018). According to Mahmoud (2008), POS has significant influences on the relationship between TL and KS. In addition, employees tend to be reluctant to share their key knowledge with others because they dreaded of losing their distinctiveness compared with colleagues (Wang and Noe, 2010), especially in case of without awareness of integrity and fairness of organization. Thus, if employees have high trust of support, integrity and fairness in their organization, they will have greater motivation and commitment to actively participate in the activities of KS. It is clearly that KS activities under different POS may create dissimilar influences that can promote or hinder the correlation between TL and KS effectiveness (Donate and Guadamillas, 2011; Raab *et al.*, 2014). Therefore, investigating the potential moderating role of POS is very meaningful in increasing the understanding on the relationships between TL and KS. So following hypothesis is posed:

H5a. POS positively moderates the relationship between TL and KS.

In case of relationship between POS and innovation capability, some prior research showed that POS plays an important role in employees' creativity, because it arouses and increases the creative likelihood (Zhou and George, 2001) and employees' interest in their work (Appu and Kumar Sia, 2015). The work by Suifan *et al.* (2018) indicated that POS will generate a sense of duty of employees in caring about the organization's benefit and strive to achieve its goals in the most creative way. Choi *et al.* (2016) argued that POS stimulates employees to participate in innovation and decision-making process related to innovation through its supportive mechanism. These scholars emphasized that POS can facilitate transformational leaders to unite and motivate employees to perform the organizational vision through innovation. It also ensures that employees are highly committed to the work of the organization which causes the high motivation to share more knowledge to innovate and solve firm's existing issues. Consequently POS will positively moderate the effects of TL on

KS and innovation capability. Overall, Firms with high degree of POS will strengthen the positive effect of TL on innovation capability based on developing intrinsic and extrinsic motivation among the employees for innovation. In other words, the degree of employees' POS can stimulate or inhibit the relationship between TL and the success of KS. For given reason addressed above, to deepen understanding the mechanism of POS's influence on relationship between TL and each specific aspects of innovation capability, we propose following hypotheses:

H5b. POS positively moderates the relationship between TL and product innovation.

H5c. POS positively moderate the relationship between TL and process innovation.

3. Research methodology

3.1 Sample and data collection

The paper used the survey method based on using questionnaire to collect data. To select participants, we examined a total of 150 Chinese firms randomly selected from *Wind Info's 2015 list* of approximately 16,500 enterprises in Hunan Province. To meet research needs, the respondents in our research need to be key employees who are team leaders or leaders at departments of administration, R&D, accounting, operation, marketing and sales to ensure the necessary understanding of their firm as well as frequently exchanging strategic information in the organization. In summer 2017, we connected with representatives of 150 firms by phone and/or made personal visits to explain the motivation of the work and ask for their assistance in collecting the questionnaires. Among of which, 88 firms are willing for support. In the formal data collection, 690 questionnaires were issued to participants, and 465 responses were received. Of the responses, 394 were valid, corresponding to a validity rate of 57.1 per cent.

3.2 Variable measurement

To ensure the validity and reliability of the study, the variables were measured using items developed and used in previous studies. All constructs were measured using multiple items, and all items were measured via five-point Likert-type scales ranging from "1" (strongly disagree) to "5" (strongly agree) or from "1" (strongly unwilling to) to 5 (strongly willing to).

TL. Based on the strategic literature on investigations that measures and evaluates TL ([Masa'deh et al., 2016](#); [Le et al., 2018](#)), we acknowledged participants' perceptions of their leader about TL behaviour with eight items adapted from [Dai et al. \(2013\)](#). Sample items are, "Our leader encourages me to think about problems from a new perspective"; "Our leader encourages us to make efforts towards fulfilling the company vision"; and "Our leader can understand my situation and give me encouragement and assistance".

KS. We used 10 items adapted from the research of [Cheng and Li \(2001\)](#) to measure the activities of KS among employees. Sample items are: "I am usually willing to share my knowledge and experience with others", and "When my colleagues are in need, I do my best to offer them needed information and documents".

Innovation capability. This study used 11 items adapted from the research of [Tsai et al. \(2001\)](#) and [Liao et al. \(2007\)](#) to measure two specific types of innovation. Among these, five items used to measure process innovation, an example is "Our firm can develop more efficient manufacturing process or operation procedure", and six items used to measure product innovation, an example is "Our firm often develops new products and services well accepted by the market".

POS. This study used eight items developed by [Eisenberger et al. \(1986\)](#) to determine the level of employees' perceptions of organizational support. These items were also adopted in the studies of [Akgunduz et al. \(2018\)](#). Sample items include "Our firm really cares about employees' well-being", and "Our firm strongly considers employees' goals and values".

Control variables. Firm characteristics of industry type, firm age and firm size were used as control variables to account for differences among firms that have potential impacts on innovation capabilities. It is consistent with previous research (Birasnav *et al.*, 2013).

3.3 Common method bias

Scholars argue about the effects of common method bias (CMB) in self-reporting variables (Conway and Lance, 2010). Prior literature has indicated several statistical methods to identify and control for any possible CMB (Chang *et al.*, 2010). This study used Harman's single-factor test to check for CMB. The result shows the overall variance is less than the 50 per cent threshold for substantive common method variance. This indicated that CMB was not a concern.

3.4 Data analysis methods

Analysis of Moment Structures (AMOS) was used for measurement validation and to examine the structural model based on the data gathered from the 394 respondents in 88 manufacturing and service firms. Data analysis was conducted using SPSS and AMOS version 21. Confirmatory factor analysis (CFA) was implemented to examine the validity and reliability of the constructs.

4. Data analysis and results

4.1 Measurement model

We first tested the reliability of the measures of the constructs by examining the individual Cronbach's alpha ($C\alpha$) coefficients, which ranged from 0.93 to 0.96 and were all higher than the recommended level of 0.7 (Nunnally and Bernstein, 1994). We then performed CFA to assess the convergent and discriminant validity of the overall measurement model.

We evaluate the convergent validity as recommended by Hair *et al.* (2006). The results in table I show the model met the Hair *et al.*'s (2006) convergent validity criteria because:

- all factor loadings range from 0.80 to 0.94 (*all larger than 0.6; $p < 0.001$*);
- CR values range from 0.94 to 0.96 (*all higher than 0.7*); and
- the AVE values range from 0.73 to 0.79 (*all greater than 0.5*).

Discriminant validity is the degree to which factors that are supposed to measure a specific construct do not predict conceptually unrelated criteria (Fornell and Larcker, 1981). This study used Fornell and Larcker's (1981) measure of AVE to assess discriminant validity. The discriminant validity of the research instrument was assessed by comparing the square root of the AVE with the correlations among the latent variables. Table II shows that the square root of AVE for each construct (diagonal elements in bold) is greater than the correlations among constructs in the model. It, therefore, provided strong support for the construct reliability, as well as for the convergent and discriminant validity of the scales.

Regarding the satisfactory of measurement model, Table III shows that all fit indices of the measurement model were satisfactory; thus, the model fit the data.

4.2 Structural model

This section presents the main results of the hypothesis testing of the structural relationships among the latent variables.

4.2.1 Direct effects analysis. Multiple regression analyses were performed separately with the results shown in Table IV. Findings show that all the path coefficients of direct effects are found to be significant and in line with the stated hypothesis. Specifically:

Table I Standardize loadings and reliabilities for measurement model					
<i>Construct</i>	<i>Item</i>	<i>Loading</i>	<i>AVE</i>	<i>CR</i>	<i>Cα</i>
TL	TL1	0.86***	0.73	0.96	0.96
	TL2	0.91***			
	TL3	0.89***			
	TL4	0.80***			
	TL5	0.89***			
	TL6	0.91***			
	TL7	0.87***			
	TL8	0.89***			
POS	POS1	0.87***	0.77	0.96	0.96
	POS2	0.90***			
	POS3	0.80***			
	POS4	0.89***			
	POS5	0.92***			
	POS6	0.89***			
	POS7	0.89***			
	POS8	0.85***			
KS	KS1	0.89***	0.77	0.97	0.97
	KS2	0.82***			
	KS3	0.84***			
	KS4	0.88***			
	KS5	0.87***			
	KS6	0.86***			
	KS7	0.87***			
	KS8	0.86***			
	KS9	0.85***			
	KS10	0.84***			
Process innovation (PCI)	PCI1	0.90***	0.75	0.94	0.94
	PCI2	0.85***			
	PCI3	0.86***			
	PCI4	0.82***			
	PCI5	0.91***			
Product innovation (PDI)	PDI1	0.85***	0.79	0.96	0.96
	PDI2	0.86***			
	PDI3	0.94***			
	PDI4	0.83***			
	PDI5	0.92***			
	PDI6	0.93***			

Notes: $C\alpha \geq 0.7$; composite reliability ≥ 0.7 ; average variances extracted ≥ 0.5 ; *** Significant at $p < 0.001$

Table II Descriptive statistics and average variance extracted from constructs							
<i>Construct</i>	<i>Mean</i>	<i>SD</i>	<i>TL</i>	<i>POS</i>	<i>KS</i>	<i>PCI</i>	<i>PDI</i>
TL	3.43	0.59	<i>0.86</i>				
POS	3.51	0.64	0.58	<i>0.88</i>			
KS	3.61	0.58	0.64	0.67	<i>0.88</i>		
Process innovation (PCI)	3.78	0.59	0.68	0.68	0.70	<i>0.87</i>	
Product innovation (PDI)	3.74	0.63	0.71	0.67	0.69	0.67	<i>0.89</i>

Notes: $C\alpha \geq 0.7$; $CR \geq 0.7$; $AVE \geq 0.5$; SD : standard deviation. Diagonal elements (in italic) are the square root of the AVE; Off-diagonal elements are the correlations among constructs

Model 1 shows that TL is positively related to KS ($\beta = 0.595$; $p < 0.001$). Thus, $H1$ is supported.

Models 2 and 3 indicate that TL is positively associated with process innovation ($\beta = 0.625$; $p < 0.001$) and product innovation ($\beta = 0.591$; $p < 0.001$). Thus, $H2a$ and $H2b$ are

Table III Overall fit index of the CFA model

<i>Fit index</i>	<i>Scores</i>	<i>Recommended threshold value</i>
<i>Absolute fit measures</i>		
CMIN/df	2.211	$\leq 2^a$; $\leq 5^b$
GFI	0.847	$\geq 0.90^a$; $\geq 0.80^b$
RMSEA	0.056	$\leq 0.08^a$; $\leq 0.10^b$
<i>Incremental fit measures</i>		
NFI	0.924	$\geq 0.90^a$;
AGFI	0.825	$\geq 0.90^a$; $\geq 0.80^b$
CFI	0.957	$\geq 0.90^a$;

Notes: ^aAcceptability: acceptable; ^bacceptability: marginal; RMSEA: root mean square error of approximation; GFI: goodness of fit index; CFI: comparative fit index; NFI: normed fit index; AGFI: adjusted goodness of fit index

Table IV The effects of interpersonal trust on KS and innovation capabilities

<i>Variable</i>	<i>Innovation capability</i>				
	<i>KS Model 1</i>	<i>PCI Model 2</i>	<i>PDI Model 3</i>	<i>PCI Model 4</i>	<i>PDI Model 5</i>
<i>Control variable</i>					
Firm size	0.172**	0.163**	0.232***	0.089*	0.170**
Firm age	-0.006	0.022	0.142**	0.079	0.200**
Industry type	-0.022	0.027	-0.026	0.022	-0.033
<i>Independent variable</i>					
TL	0.595***	0.625***	0.591***		
KS				0.650***	0.577***
R^2	0.429	0.491	0.605	0.515	0.586
Adjusted R^2	0.423	0.485	0.600	0.510	0.581
F	73.06***	93.81***	148.9***	103.2***	137.6***

Notes: *** $p < 0.001$; ** $p < 0.05$; $N = 394$; PCI: process innovation; PDI: product innovation

supported. The findings also show that TL's influence on process innovation is more significant than its influence on product innovation ($0.625 > 0.591$).

Models 4 and 5 show that KS's effect on process innovation ($\beta = 0.650$; $p < 0.001$) is larger than its effect on product innovation ($\beta = 0.577$; $p < 0.001$). Thus, *H3a* and *H3b* are supported.

We examine the control role of firm age, firm size and industry type for innovation capabilities over 4 (Models 2-5). The results indicate that only the effect of firm size and on aspects of innovation is significant at p -value less than 0.01. It implies that firms with greater size will have greater potential to innovate their products and process.

4.2.2 Test of the mediating effect. Models 6 and 7 in [Table V](#) show that after KS has been added as a mediator between TL and process innovation (Model 6) and between TL and product innovation (Model 7), KS's effects on process innovation ($\beta = 0.429$; $p < 0.001$) and product innovation ($\beta = 0.348$; $p < 0.001$) are significant. However, for TL's effects, as compared with models 2 and 3, the direct effect of TL on process innovation decreases from 0.625 ($p < 0.001$) to 0.374 ($p < 0.001$) and its effects on product innovation decreases from 0.591 ($p < 0.001$) to 0.391 ($p < 0.001$); thus, KS partially mediates the effects of TL on two aspects of innovation capabilities (process innovation and product innovation).

Moreover, to provide evidence on the mediating roles of KS between TL and aspects of innovation capabilities, the paper implements further analyses to verify the magnitude and

Table V Test of mediating and moderating effects

Variable	Mediating effect				Moderating effect		Product innovation	
	PCI Model 6	PDI Model 7	KS Model 8 Model 9		Process innovation Model 10	Model 11	Model 12	Model 13
<i>Control variable</i>								
Firm size	0.092*	0.176***	0.106*	0.092*	0.102*	0.089	0.182***	0.171***
Firm age	0.032	0.152**	-0.042	-0.027	0.05	0.018	0.128**	0.140**
Industry type	0.030	-0.024	0.005	0.010	0.037	0.041	-0.017	-0.073
<i>Independent variable</i>								
TL	0.374***	0.391***	0.362***	-0.234	0.411***	-0.135	0.416***	-0.82
<i>Mediators</i>								
KS	0.429***	0.348***						
<i>Moderators</i>								
POS			0.441***	-0.157	0.407***	-0.142	0.332***	-0.162
<i>Interaction variable</i>								
TL*POS				0.174***		0.157***		0.140***
F^2	0.591	0.665	0.552	0.537	0.596	0.583	0.674	0.664
Adjusted R^2	0.585	0.660	0.546	0.531	0.590	0.576	0.669	0.658
F	112.1***	154.0***	95.61***	90.00***	114.5***	90.17***	160.4***	127.5***

Notes: *** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$; N = 394; PCI: process innovation; PDI: product innovation

the statistical significance of the indirect effects. For statistical inferences as the suggestion of Preacher and Hayes (2008), we used the bootstrap confidence intervals method with 5,000 iterations to test the significance of indirect effects (see Table VI).

The results in Table VI indicated that the indirect effects of TL on process innovation ($\beta = 0.275$; $p < 0.001$) and product innovation ($\beta = 0.223$; $p < 0.001$) are significant within the range of confidence intervals. Thus, H4a and H4b are supported. In general, these findings are the first to confirm the mediating role of KS in the relationship between TL and innovation capabilities.

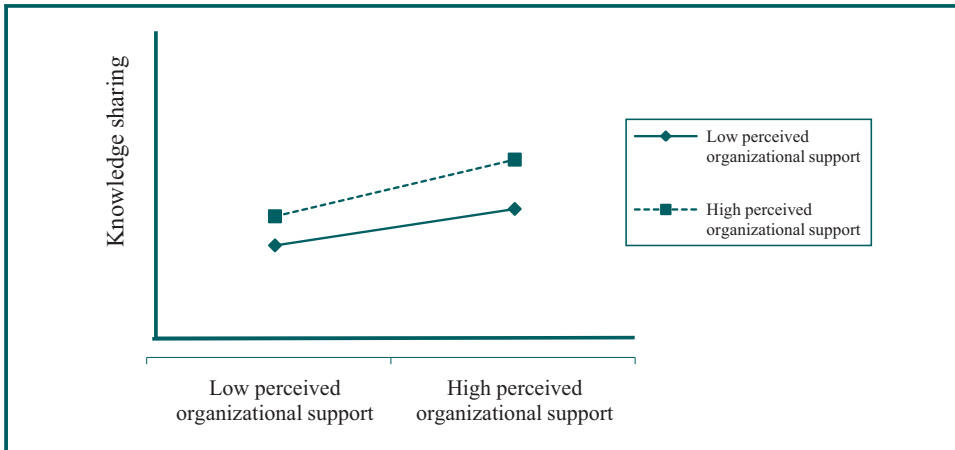
4.2.3 Test of the moderating effect. Models 8 and 9 are the test results on the moderating effect of POS between TL and KS. The results show that direct effect of POS on KS is significant ($\beta = 0.441$; $p < 0.001$). Especially, TL*POS has a significant effect on KS, with $\beta = 0.174$ ($p < 0.001$); therefore, H5a is verified (Figure. 2).

Models 10-13 are the test results on the moderating effect of POS between TL and aspects of innovation capability. The results show that direct effect of POS on process innovation ($\beta = 0.407$; $p < 0.001$) and product innovation ($\beta = 0.332$; $p < 0.001$) are significant. Moreover, TL*POS has significant effects on process innovation ($\beta = 0.157$; $p < 0.001$) and product innovation ($\beta = 0.140$; $p < 0.001$); therefore, H5b and H5c are

Table VI Confidence intervals of the indirect effects

Path	Direct effects	Indirect effects	Total effects	Bias-corrected confidence intervals	
				Lower confidence level	Upper confidence level
TL→KS→PCI	0.374***	0.275***	0.649***	0.221	0.334
TL→KS→PDI	0.391***	0.223***	0.614***	0.177	0.277

Notes: *** $p < 0.001$; TL: Transformational leadership; KS: knowledge sharing; PCI: process innovation; PDI: product innovation

Figure 2 The moderation effect of POS on the relationship between TL and KS

also confirmed. These results show that POS plays a positive moderating role between TL and innovation capabilities (Figures 3 and 4).

5. Discussions

Strengthening innovation capability has considered a key to open a door to firm's success. The current study reveals that TL has a positive influence on KS and thus significantly enhances firm's innovation capabilities. The assessment of the hypotheses developed in this paper significantly contributes to the theoretical and practical initiatives in the fields of innovation and knowledge management.

5.1 Theoretical contributions

Our study makes significantly contributions to theories of innovation and knowledge management in the following ways.

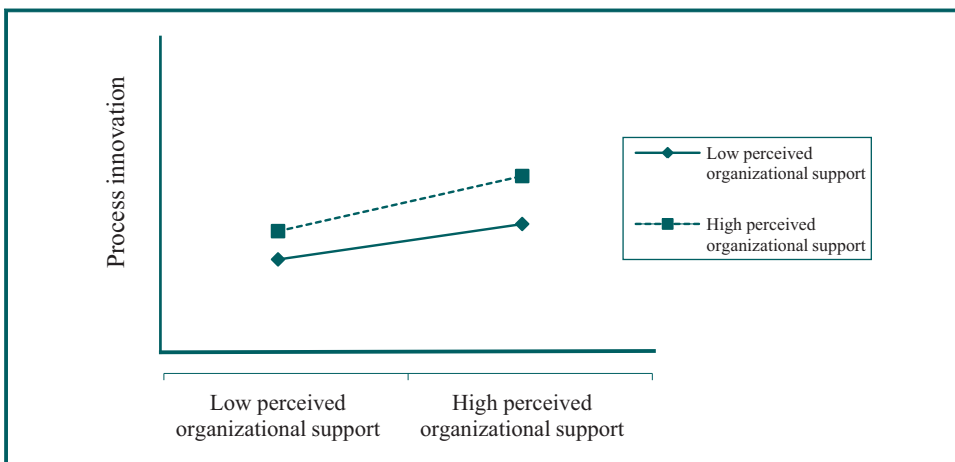
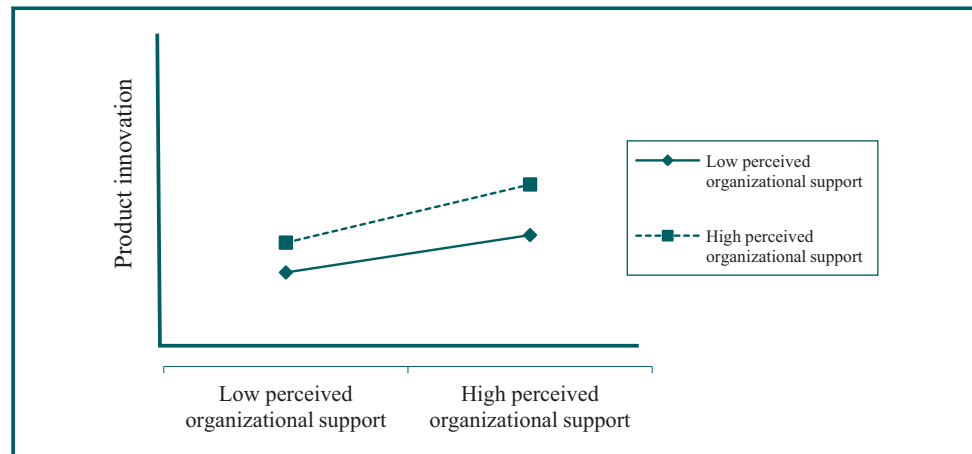
Figure 3 The moderation effect of POS on the relationship between TL and process innovation

Figure 4 The moderation effect of POS on the relationship between TL and product innovation



First, although TL is regarded as one of the most effective leadership styles, TL-KS and TL-innovation relationships have received little research attention (Wang and Noe, 2010; Choi *et al.*, 2016; Le and Lei, 2017; Jia *et al.*, 2018). To fill the research gaps, this study proposes a research model to link TL with KS and two aspects of innovation capability. The empirical findings verify the significant influences of TL on KS and innovation capabilities. The findings imply that the TL practice might provide firms not only an appropriate climate to stimulate KS among employees, but also an effective pathway to positively foster firm's product innovation and process innovation.

Second, Anderson *et al.* (2014) supposed that knowledge is an essential ingredient for creativity but empirical studies on how this factor affects activities of creativity and innovation in the workplace are still scarce and limited. Choi *et al.* (2016) also called for exploring the KS's mediating mechanism between TL and innovation behaviors. To respond to calls of Anderson *et al.* (2014) and Choi *et al.* (2016), the paper has connected TL and two aspects of innovation capability based on mediating role of KS. The empirical findings verify that, KS that is an organization's strategic and invisible resource has positive and significant influences on two specific aspects of innovation capability (product innovation and process innovation). KS also serves as an effective mediator between TL and two specific aspects of innovation capability. These findings have also provided a clear answer to the Anderson *et al.*'s (2014) question: "What is the relationship between organizational resources and different types of organizational innovation?" In general, this study extends the integrative theory of the relationship of TL with innovation capabilities via the mediating role of KS and highlights the significant direct or indirect effects of TL on product innovation and process innovation through its positive effect on KS. The results revealed that TL motivates employees to share more knowledge, skill and expertise which result in improving innovation capability. Shared knowledge helps TL and employees respond to new information and external environment rapidly, fulfill the task in efficient manner, and solve existing problems, resulting in enhanced innovative capacity of employees (Choi *et al.*, 2016).

Finally, to respond to scholars for identifying clearer mechanisms of POS in moderating the organizational relationships, especially the relationship between TL and innovation activities (Choi *et al.*, 2016; Cheng and Yi, 2018), this study investigates the influence of POS on the effects of TL on product innovation and

process innovation. The empirical findings provide the evidence that POS positively moderates the relationship between TL and innovation capabilities. The findings significantly contribute to putting leadership and innovation literatures forward by introducing POS as the situational variable that interacts with TL to positively influence innovation capability. The findings reveal that TL's influences on KS and innovation capability may have differences in the effectiveness and results depended on the extent of employee's POS. More specifically, this finding implies that if leaders pay much attention on encouraging and providing the necessary help and resources for employees to share knowledge, and if employees perceive that the success in their goal and career are closely related to the success of KS, they will actively participate in process of sharing their expertise and knowledge, consequently increases firm innovation capability.

5.2 Practical contributions

Based on its theoretical contributions and the empirical analyses, this study provides a better understanding of the causal correlations among TL, KS and innovation capabilities. This study therefore has value to directors/managers in Chinese firms as a reference for practicing organizational supports, fostering KS activities and improving innovation capabilities in their firms. Specific managerial implications include the following.

First, the findings show that TL practice is the key solution to stimulate KS activities which in turn lead to innovation. TL practice might be the best way to build trust among employee (Le and Lei, 2017) which help to reduce the vulnerability and risk inherent in interpersonal ties at the workplace (Bligh, 2017). This will help to foster KS for innovation (Anderson *et al.*, 2014; Bligh, 2017). The paper has provided directors/managers a significant implication, practical guidance, and clear pathway leading to each aspect of innovation. More specifically, the findings indicate that both TL and KS are more significantly associated with process innovation compared with product innovation. The main reason may be that TL practice encourages employees freely in discussing and trying out innovative ideas, processes, procedures or structures (Jung *et al.*, 2003; Trung *et al.*, 2014); while KS among employees helps firms to develop more efficient manufacturing process or operation procedure (Maurer, 2010; Birasnav *et al.*, 2013; Alsharo *et al.*, 2017). Thus, focusing on TL practice will help directors/managers to build a culture of trust, to arouse and stimulate KS among employees for increasing innovation capabilities especially for process innovation.

Second, the empirical findings show that POS is very necessary to stimulate employees' willingness to share knowledge and innovation capabilities. The high degree of POS can increase the effects of TL on KS and innovation. Prior analysis has shown that external factors can enhance the level of KS and innovative behavior among employees (Chen, 2002; Choi *et al.*, 2016). Our findings complement previous research by revealing how POS strengthens the effect of TL on KS and innovation capability. The findings are in line with the idea that employee's behaviors in KS and innovation is long-term work and needs external support to make it effective (Spreitzer, 1995). In this sense, employees might need significant financial or non-financial support, and POS can help in this juncture. We understand that POS provides critical conditions to encourage employees to share knowledge and to proactively renew firm's product and process.

Third, according to Griese *et al.* (2012), knowledge generation activities within an organization can produce to strategic resources and competences which permit firms to perform better than others and to achieve higher favorable outcome such as innovation performance. The findings stressed that KS is a driving force of innovation, and employees play a dominant role in the process of sharing knowledge. Thus, directors/managers should concentrate in finding the effective pathway and

appropriate method to create motivation that stimulates employees to positively and actively participate in KS process for innovation. For example: directors/managers can design a well-structured reward strategy to support employees to collect, share, and apply knowledge. The contents related to the employees' involvement in the knowledge management process should be integrated in the performance appraisal process (Birasnav *et al.*, 2013). Consequently, once employees apprehend that the success in their goal and career is closely related to the involvement in KS activities, they will actively share their key knowledge and expertise to turn personal knowledge into organizational or collective knowledge and positively contribute firm's innovation capabilities. Finally, by examining the influences of the control variables such as firm size, firm age, and firm type, we found that firm size is significantly correlated with firm's innovation capability. This implies that firms with greater capital and resources can have more opportunities and capabilities to renew their product and process. In line with this result, the research by Laursen and Salter (2004) noted that larger firms tend to spend huge amount of resources to perform research with universities and more time to train their employees to urge activities for innovation.

5.3 Limitations and directions for future research

Although the paper contributes significant understanding and values to the literature, it also has certain limitations. First, the cross-sectional design does not eliminate the possibility that causal correlation may emerge in the long term due to changes in the psychology and trust of individuals over time. A longitudinal study would overcome this limitation and consolidate the results. Second, knowledge is widely accepted as core and lasting resources enabling firms to innovate and sustain competitive advantage (Chen and Hou, 2016). This study has only focused on investigating the mediating role of KS (which is a key component in process of knowledge management) between TL and innovation capability. To have full understanding of important role of knowledge capital toward innovation capability of organizations, future works should test mediating mechanism of knowledge management process and its constituents (knowledge acquisition, KS, and knowledge application) between TL and specific aspects of innovation capability. Finally, the collectivistic essence of Chinese culture (Ma *et al.*, 2008) creates a challenge to the understanding of characteristics in KS between state firms and non-state firms and affecting innovation capabilities. To help directors/managers to have more understanding of factors, process, and mechanism affecting innovation, future studies should explore more deeply the relationship between latent variables by assessing the moderating roles of firm ownership forms which might influence the transformation of KS into better innovation.

6. Conclusions

The paper's findings provide significant theoretical and practical implications for literature on leadership, knowledge management, and innovation that can be used to analyze the relationships among TL, KS, and innovation capabilities. The findings verify the hypotheses that TL and KS have positive and significant roles in promoting product innovation and process innovation. The findings also provide the empirical evidences on mediating mechanism of KS between TL and innovation capabilities, as well as the moderating role of POS in the effects of TL on KS and innovation. Overall, the findings of this study differs from previous work and deepens understanding of the pathways and conditions to improve specific aspects of innovation capability namely product and process innovation by examining the mediating role of KS and moderating mechanism of POS. The paper highlights the important role of practicing TL style together with operating the appropriate, necessary and timely supports in

long time to help directors/manages to create a positive environment that facilitates KS activities and significantly contribute to enhancing innovation capabilities for their firms.

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Corresponding authors

Phong Ba Le can be contacted at: lebaphong.vn@gmail.com

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