RESEARCH ON TRIGGER FACTORS OF KNOWLEDGE ACQUISITION AND ITS INFLUENCE MECHANISM ON TEAM CREATIVITY

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Research on Trigger Factors of Knowledge Acquisition and its Influence Mechanism on Team Creativity

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CERTIFICATE OF ORIGINALITY

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_____ (Signed）

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Abstract

In this highly competitive era, firms face dynamic environments which are characterized by rapidly technological change and intense competition. For example, the instability of market demand, changes in industry structure, and the probability of environmental shocks are crucial elements of environmental dynamism. In a dynamic environment, organizations rely on creative and novel ideas from their employees, and creativity has been argued to be the crucial enabler for growth, performance, and competitiveness, because creativity helps organizations to reap pioneering advantages and affects firm-level strategies driving skills and market position in highly dynamic environments. Consequently, creativity is a core competence for organizations to maintain or enhance effectiveness in highly dynamic environments.

Today, even the largest innovation-active organizations cannot rely solely on internal knowledge; they also require external knowledge when developing their creative ability in highly dynamic environments. Due to the potential influence of knowledge acquisition on creativity, it is crucial to find out how to trigger knowledge acquisition, which includes external knowledge search and internal knowledge sharing (i.e. Liu & Dang, 2013). Thus, the purpose of this study was to examine the trigger factors of knowledge acquisition (including external knoweldge search and internal knowledge sharing) and its influence mechanism on team creativity.

In this study, we employed both qualitative and quantitative research methods. Specifically, first, we used qualitative method to explore the trigger factors of knowledge acquisition, which includes external knowledge search and internal knowledge sharing. Results showed that calling-orientation, personality, career-orientation, team climate, organizational/team culture, and organizational strategy are the main triggers of external knowledge search; Calling-orientation, personality, career-orientation, team climate, relationship perception, and organizational/team culture are the main triggers of internal knowledge sharing. Calling-orientation and personality traits belong to intrinsic triggers, while

career-orientation, team climate, organizational/team culture, relationship perception, and organizational strategy belong to cognitive triggers.

Second, we used quantitative method to examine how knowledge acquisition (including external knowledge search and internal knowledge sharing) affects team creativity. Results showed that both external knowledge search and internal knowledge sharing are positively related to team creativity, and absorptive capacity and knowledge integration play mediating roles in the relation between internal knowledge sharing and team creativity, as well as in the relation between external knowledge search and team creativity.

Third, we used quantitative method to explore the moderating roles of environmental dynamism and task characteristics in the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and team creativity. Results showed that environmental dynamism plays a moderating role in the relation between external knowledge search and absorptive capacity, as well as in the relation between external knowledge search and knowledge integration. In addition, results showed that task interdependence and task complexity play moderating roles in the relationship between absorptive capacity and team creativity, as well as in the relationship between knowledge integration and team creativity.

In practice, our research can help to explain how and when knowledge acquisition facilitates team creativity, and what managers and employees should do about it.

Keywords: knowledge acquisition, team creativity, environmental dynamism, task characteristics

Publications arising from the thesis

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Notes:

The paper "When and how knowledge sharing benefits team creativity: The importance of cognitive team diversity", which is accepted by Journal of Management & Organization, belongs to one section of my thesis (Chapter 4).

The paper "Translating external knowledge to team creativity in turbulent environments: The role of absorptive capacity and knowledge integration", which is submitted to the Journal of Creative Behavior, belongs to one section of my thesis (Chapter 4).

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Chapter 1: Introduction

1.1 Background

1.1.1 Practical background

The Report of the Nineteenth National Congress of the Communist Party of China demonstrated that scientific and technological innovation provides strategic support for raising the productive forces and boosting the overall national strength. Accordingly, enterprises should take measures to prompt innovation to catch up with global advances. Also, enterprises should enhance their capacity for making original innovation and integrated innovation on the basis of absorbing advances in overseas science and technology, and place greater emphasis on making innovation through collaboration.

The major reason why enterprises choose innovation-driven development strategy is to accommodate the economic development situation. More specifically, since the policy of reform and opening up was introduced in China, enterprises have realized their rapid growth and expansion relying on capital, resources, and labor force. However, nowadays, the competitive advantage of enterprises relying on demographic dividend, cheap labor force, and high-quality natural resources is diminishing. Thus, enterprises should accelerate the transition from elements-driven to innovation-driven and emphasize the role of technological innovation.

Many countries have valued the importance of innovation since the financial crisis in 2008. For example, previous Russian President Dmitry Medvedev (2008) pointed out in his report that the Russian economy focused on both knowledge industry and new technology industry. In addition, previous US President Barack Obama (2009) in his inaugural speech repeatedly stressed that the restoration of science should have the status.

In China, firms face dynamic environments which are characterized by rapid technological change and intense competition, and there are increasingly frequent calls to pursue creativity and innovation as a source of competitive advantage in highly competitive and rapidly changing environments. More specifically, in a competitive environment, enterprises need to explore new manufacturing processes, products, and services to maintain their survival and development. However, even the largest innovation-active organizations cannot rely solely on internal knowledge; they also require knowledge from beyond their boundaries when developing their innovations (Rigby & Zook, 2002). Thus, organizations should emphasize the importance of both internal knowledge and external knowledge.

In addition, in the era of knowledge economy, creativity and innovation rely on knowledge. However, an individual's knowledge and skills cannot meet the requirements of innovation, enterprises need to re-examine the organizational structure (Jaakkola & Hallin, 2018). Consequently, knowledge teams, which refer to organizational units exploiting team members' knowledge to create new knowledge, products, and services (Nonaka & Takeuchi, 1995), play important roles in organizational innovation. More specifically, in knowledge teams, team members can acquire a wide range of cognitive resources and produce creative ideas through cooperation.

1.1.2 Theoretical background

Research on creativity derives from a famous speech—theory of creativity (Guilford, 1950). Guilford (1950) argued that creativity is a continuous trait, and that an individual with recognized creative talent simply has "more of what all of us have" (Guilford, 1950: 446). In the middle of 20th century, research on creativity mainly focused on individual cognition and personality. For example, Kurtzberg and Amaiable (2001) explored how creative minds interact with group processes to improve creativity. Simultaneously, they offered suggestions for future research on creativity as "a dynamic, team-level process" (Kurtzberg & Amaiable, 2001: 285).

After that, scholars tried to clarify the essence of team creativity. However, to date, scholars have not yet reached a consensus on the essence of team creativity. More specifically, scholars who focused on team composition argued that individual creativity is a key factor of team creativity. For example, Woodman, Sawyer and Griffin (1993) argued that team creativity is a function of individual creativity, and it can be influenced by team composition, team characteristics, team processes, and organizational climate. Pirola-Merlo and Mann (2004) showed that team creativity is the average value of individual creativity. However, some scholars argued that individuals may have different levels of creativity in different circumstances, and team creativity is not equivalent to the sum of individual creativity (Drazin & Kazanjian, 1999). For example, West (2002) argued that task characteristics, group knowledge diversity and skill, and external demands are important factors of team creativity. Also, Anderson, Potocnik and Zhou (2014) argued that the main factors that influence team creativity include team composition, team climate, team process, leadership type, and team knowledge.

Knowledge can be divided into explicit knowledge (e.g., words, numbers, and sounds) and tacit knowledge (e.g., belief and skills). According to Nonaka and Takeuchi's (1995) SECI model, team members can acquire tacit knowledge such as mental models and skills through knowledge sharing. More specifically, in the process of transforming tacit knowledge into explicit knowledge, knowledge sharing can help team members to be familiar with relevant knowledge which is beneficial to creativity. However, Cassiman and Veugelers (2006) argued that organizations cannot rely solely on internal knowledge, and they need to acquire knowledge from beyond their boundaries when developing their innovations.

Recently, researchers have begun to explore the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and creativity. For example, Huang, Hsieh, and He (2014) examined the relationship between internal knowledge sharing and individual creativity and they found that knowledge sharing is positively related to individual creativity. In addition, Soo,

Devinney and Midgley (2007) argued that external knowledge search has critical implications for individual creativity. However, previous research focused on individual level creativity, and did not investigate the underlying influence processes, leaving unclear how knowledge acquisition shapes team creativity. In addition, prior work mainly focused on either internal knowledge sharing or external knowledge search, and did not comprehensively explore the trigger factors of external knowledge search and internal knowledge sharing. Thus, in this study, we will explore the trigger factors of knowledge acquisition and examine the mechanism through which knowledge acquisition influences team creativity.

Furthermore, we will explore the influence of knowledge acquisition on team creativity in highly turbulent economic environments, as well as in complex and interdependent task environments. In general, this study will provide important theoretical and practical implications for prompting knowledge management and team creativity.

1.2 Research questions and objectives

In this study, we will explore the trigger factors of knowledge acquisition (including external knowledge search and internal knowledge sharing) and how knowledge acquisition affects team creativity.

First, we will explore the trigger factors of knowledge acquisition. More specifically, we will employ a case study to explore the trigger factors of external knowledge search and internal knowledge sharing. Although previous research has explored the influencing factors of external knowledge search and internal knowledge sharing, it focused on empirical research. For example, Danneels (2008) argued that redundant resources have an inverted U-shaped effect on external knowledge search; Witherspoon et al. (2013) showed that willingness, culture, and reward are important influencing factors of internal knowledge sharing. In this study, we will employ a case study to explore the trigger factors of knowledge acquisition. It will make up for the shortcomings of quantitative research on the influencing factors of knowledge

acquisition (Chen, 2008). In addition, this study can help managers to take appropriate actions to encourage team members to search external knowledge and share their knowledge, which in turn will prompt team creativity.

Second, what is the relationship between knowledge acquisition and team creativity? How does knowledge acquisition affect team creativity? Previous research has suggested external knowledge search and internal knowledge sharing are critical to creativity. For example, Aulawi (2009) argued that internal knowledge sharing can help team members to be critical and creative, thereby enhancing team creativity. Soo et al. (2007) argued that external knowledge search is positively related to creativity. However, to date, little research has focused on how knowledge acquisition such as external knowledge search and internal knowledge sharing affects team creativity. Thus, in this study, we will explore the influencing mechanism of knowledge acquisition on team creativity. More specifically, we will examine how external knowledge search and internal knowledge sharing affect team creativity.

Third, how does environmental dynamism as well as task characteristics affect the relationship between knowledge acquisition and team creativity? More specifically, we will explore the moderating roles of environmental dynamism and task characteristics in the relationship between internal knowledge sharing and team creativity, as well as in the relationship between external knowledge search and team creativity.

1.3 Structure of this study

This thesis includes seven chapters:

Chapter 1 introduces the background of the research and the concept of team creativity. In this chapter, we presented the aim and objective of this research.

Chapter 2 gives a thorough literature review on team creativity, internal knowledge sharing, external knowledge search, absorptive capacity, and knowledge integration. The main aim of this chapter is to develop an analysis framework for team creativity.

Chapter 3 explores the trigger factors of knowledge acquisition (including external knowledge search and knowledge sharing). Grounded theory and empirical analysis will be used to explore the trigger factors of knowledge acquisition and the relationship between knowledge acquisition and team creativity.

Chapter 4 introduces a model of the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and team creativity. In this chapter, we analyzed the relationship between external knowledge search as well as internal knowledge sharing and team creativity through literature review.

Chapter 5 includes questionnaire design and small sample test. In this chapter, the definition and measures of relevant variables (e.g., internal knowledge sharing, external knowledge search, absorptive capacity, and knowledge integration) will be elaborated. In addition, in this chapter, we will elaborate the formation of initial scale and conduct small sample prediction analysis.

Chapter 6 includes a large-sample survey and hypotheses test. In this chapter, we will report the results such as means, standard deviations, correlations, and interrater reliability.

Chapter 7 shows research findings, limitations, and potentials for future research. The research framework and logic of the study are summarized in Figure 1.1.

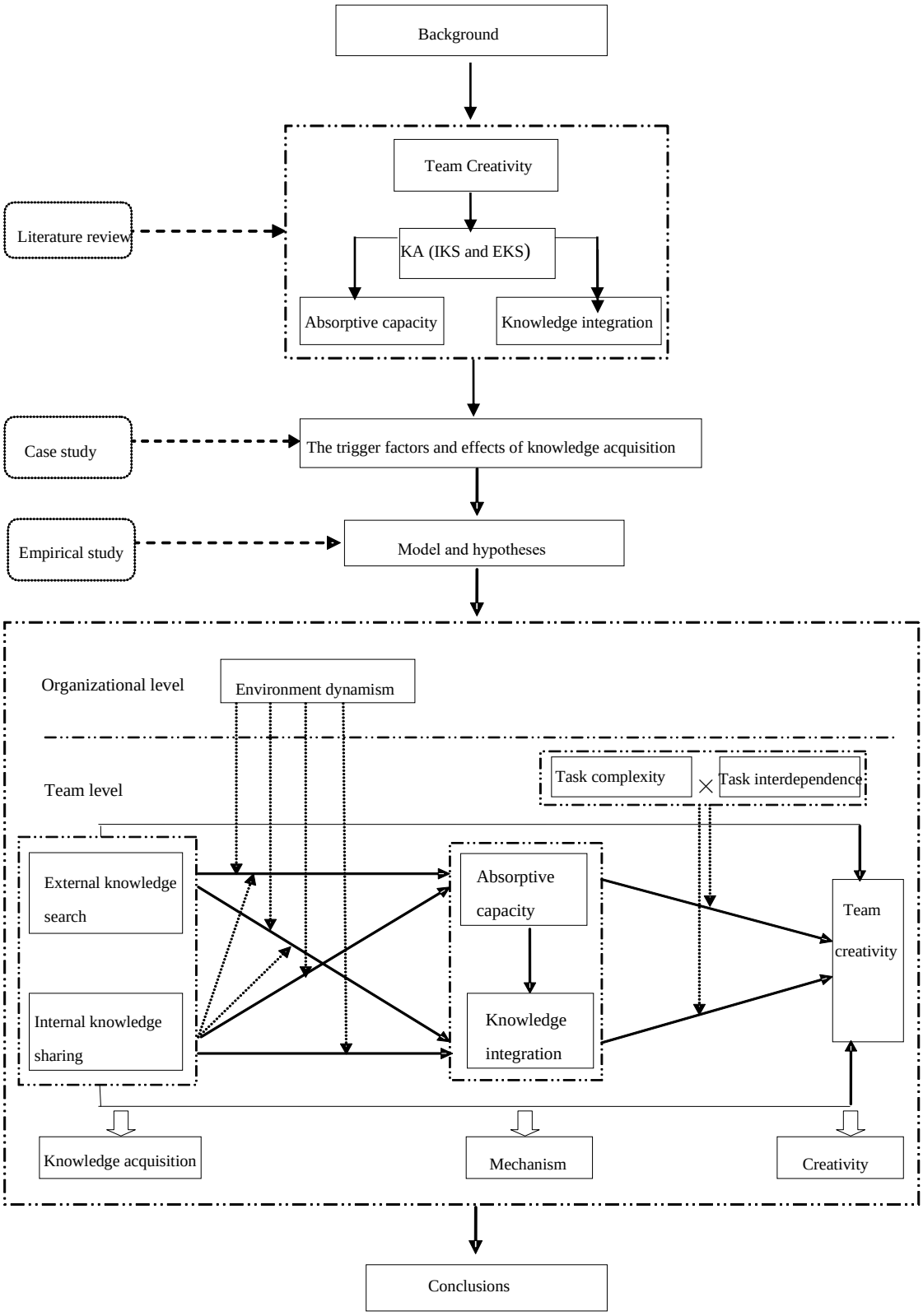


Figure 1.1 Research roadmap

1.4 Research methods

In this thesis, we conducted both qualitative analysis and quantitative analysis. Namely, we used a case study and an empirical study to explore the trigger factors of knowledge acquisition (including external knowledge search and internal knowledge sharing) and its influence mechanism on team creativity. More specifically:

Case study is used to solve questions such as “what” and “how”. To improve the reliability and validity, we adopted Hirschman’s (1986) three-step analysis. First, we selected proper interviewees that met the requirements of our study. More specifically, the interviewees are mainly from R&D teams, project teams, and research teams. Second, we conducted content analysis with the interview materials. Third, we checked the case analysis results from the perspective of interviewees.

In addition, we adopted an empirical study to explore the relationship between knowledge acquisition and team creativity. More specifically, we collected the data through questionnaire, and then analyzed the data using the software SPSS 20.0 and AMOS17.0.

1.5 Significance of the study

This study makes several meaningful contributions to the literatures on internal knowledge sharing, external knowledge search, and team creativity.

First, we advance current understanding of the trigger factors of creativity from the perspective of knowledge. More specifically, the existing research on team creativity mainly focuses on internal knowledge sharing; however, it ignores the effect of external knowledge search. In this study, we simultaneously focus on two ways of knowledge acquisition—external knowledge search and internal knowledge sharing, and explore the relationship between knowledge acquisition and team creativity. This is distinct from previous research, which focuses on either internal knowledge sharing or external knowledge search. In addition, our study demonstrates that when the level of internal knowledge sharing is high, external knowledge search is more positive to

team creativity.

Second, we explore the trigger factors of knowledge acquisition (including external knowledge search and knowledge sharing) using a case study. More specifically, previous research on the trigger factors of knowledge acquisition mainly focuses on empirical studies; however, little research has explored the trigger factors of knowledge acquisition with case studies. Based on grounded theory, we explored the trigger factors of external knowledge search and internal knowledge sharing. Results demonstrated that calling-orientation, career-orientation, personality, team climate, and culture are the trigger factors of both external knowledge search and internal knowledge sharing. Organizational strategy is a trigger factor of external knowledge search. Relationship perception is a trigger factor of internal knowledge sharing. Among them, calling-orientation and personality traits are intrinsic triggers. Career-orientation, team climate, team culture, relationship perception, and organizational strategy are cognitive triggers. At the same time, career-orientation and calling-orientation, which derive from value orientation, are motivational elements. Personality is a basic element. Team climate, relationship perception, culture, and organizational strategy belong to situational elements.

Third, we explore how knowledge acquisition (including external knowledge search and knowledge sharing) affects team creativity. More specifically, we conduct case analysis and empirical analysis to explore the underlying mechanism between external knowledge search and team creativity, as well as internal knowledge sharing and team creativity. Our study demonstrated that external knowledge search and internal knowledge sharing can improve team creativity by enhancing absorptive capacity and prompting knowledge integration. That is, we develop a multiple-mediation model that links knowledge acquisition to team creativity through absorptive capacity and knowledge integration.

Fourth, we examine the moderating roles of environment dynamism and task characteristics in the relationship between knowledge acquisition (including external knowledge search and knowledge sharing) and team creativity. Although a plethora of

research has looked at the moderating role of environmental dynamism, it focused on the organizational level. For example, Ensley, Pearce and Hmieleski (2006) argued that environmental dynamism plays a moderating role in the relationship between transformational leadership and firm innovation performance. To date, little research has explored the moderating role of environmental dynamism at the team level. In this study, we adopt a meso-level approach to explore the moderating role environmental dynamism. Results demonstrated that environmental dynamism plays a moderating role in the relationship between external knowledge search and absorptive capacity, as well as in the relationship between external knowledge search and knowledge integration. In addition, we explored the moderating roles of task characteristics in the relationship between knowledge acquisition and team creativity. Results demonstrated that task interdependence and task complexity can strengthen the positive relationship between absorptive capacity (as well as knowledge integration) and team creativity. This relationship is the most positive when both task interdependence and task complexity are high.

Chapter 2: Literature review

2.1 Research on team creativity

2.1.1 Definition, measures, and models

Research on creativity derives from the famous speech—theory of creativity by Guilford in 1950. At that time, research on creativity mainly focuses on individual level, which aims to reveal the influence of characteristics of individuals such as personality and capability on creativity (Barron, 1955; Drazin, Glyrm & Kazanjian, 1999). After that, Amabile (1983) put forward componential theory of creativity and extended the research on creativity from individual level to team level as well as organizational level.

2.1.1.1Definition of team creativity

Team creativity refers to the development of novel and useful ideas which are relevant to services, products, procedures, and processes by a team of employees working together (Farh, Lee & Farh, 2010; Shin & Zhou, 2007). There are two different viewpoints in terms of team creativity.

First, team creativity is the aggregation of individual creativity. For example, Tggar (2002) argued that team creativity is a function of individual creativity, and team creativity-relevant processes moderate the relationship between aggregated individual creativity and group creativity. Pirola-Merlo and Mann (2004) established a model of creativity aggregated across individuals and time, and they suggested that "team creativity scores could be explained statistically by aggregation processes across both people and time" (Pirola-Merlo & Mann, 2004: 235). More specifically, team creativity at a particular point in time can be explained as "either the average or a weighted average of team member creativity" (Pirola-Merlo & Mann, 2004: 235). Also, Zhang, Tsui and Wang (2011) argued that at the team level, creativity is a function of teamwork, team composition, and team identity.

Second, team creativity is characterized by integrality. For example, Harrington (1990) argued that team creativity is the result of an interactive process of creating processes, products, individuals, and the environment. Brown's (1989) study demonstrated that team creativity is the integration of individuals' knowledge, talents, energy, and skills to prompt innovation. In addition, Drazin, Glynn and Kazanjian (l999) argued that team creativity is an interactive process at the team level. Further, West (2002) defined team creativity as the process of translating internal elements into products and services through a series of creative processes. Geng, Liu and Zhang (2015) argued that team creativity refers to tem members' ability to collaborate and produce novel and useful ideas.

2.1.1.2 Measures of team creativity

There are two ways to measure team creativity: experimental study and questionnaire survey.

(1) Experimental study. In the experimental study, behavior testing and product analysis are two main methods to measure team creativity. More specifically, traditional behavior testing methods include WCAP (Williams Creativity Assessment Packet) and TCT-DP (Test for Creative Thinking-Drawing Production) (Torrance, 1988); Product analysis is an objective method to measure creativity. For example, Besemer and O'Quin (1987) developed a procedure to evaluate creative products. There are two advantages using experimental study to test team creativity. First, in the experimental study, we can control experimental conditions. Also, we can observe and understand the process of team creativity easily; second, the data obtained from experimental studis are authentic and immediate, which can reduce data deviation. However, there are some limitations to use experimental studies to test team creativity. For example, we usually use students as the research objectives, and they may not fully understand the creative process at work.

(2) Questionnaire survey. Questionnaires can be accomplished by either employees or supervisors.

There are two ways to measure team creativity. First, team creativity can be

assessed by employees. More specifically, we can measure team creativity based on the referent shift model (i.e. the basic meaning of the construct remains unchanged, but the referent is shifted to the team level; Gong et al., 2013) because individual creativity is an important factor of team creativity (Pirola-Merlo & Mann, 2004); second, team creativity can be evaluated by supervisors. This method can avoid the phenomenon of social approval (Harrington, 1990). However, this method has a higher standard. More specifically, it requires the evaluator to assess team creativity objectively and fairly.

2.1.1.3 Models of team creativity

(1) Aggregation model of team creativity. Scholars argued that team creativity can be influenced by individual creativity, personality, and team composition. Also, they considered the influence of time, background, creative process, and team climate on team creativity (e.g., Taggar, 2002; Pirola-Merlo & Mann, 2004; Woodman, Sawyer & Griffin, 1993).

1) An interactionist model of organizational creativity. According to Woodman et al. (1993), organizational creativity refers to "the creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system" (Woodman et al., 1993: 293). The interactionist model of organization provides an integrating framework that integrates important elements of creativity such as cognitive style, personality, and social influences. More specifically, in this model, individual creativity is a function of cognitive style and ability (e.g., ideational fluency, divergent thinking), antecedent conditions (e.g., biographical variables, past reinforcement history), personality factors (e.g., self-esteem, locus of control), motivation, relevant knowledge, social influences (e.g., social facilitation, social rewards), and contextual influences (e.g., task and time constraints, physical environment). Further, team creativity is a function of individual creativity, team processes (e.g., approaches to problem solving), team characteristics (e.g., size, norms, degree of cohesiveness), the interaction of the individuals involved (e.g., team composition), and contextual influences (e.g., characteristics of team task, the larger

organization). Organizational creativity is a function of team creativity and contextual influences (e.g., reward systems, organizational culture, reward systems, resource constraints). Thus, the result of creativity for the entire system derives from the complicate mosaic of individual, team, and organizational behaviors and characteristics existing at each level (Woodman et al., 1993).

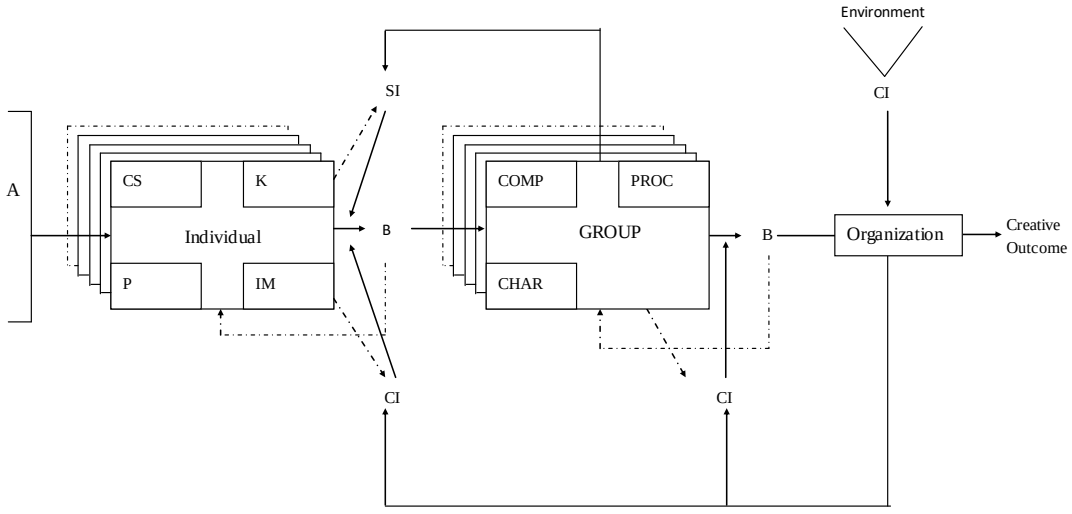
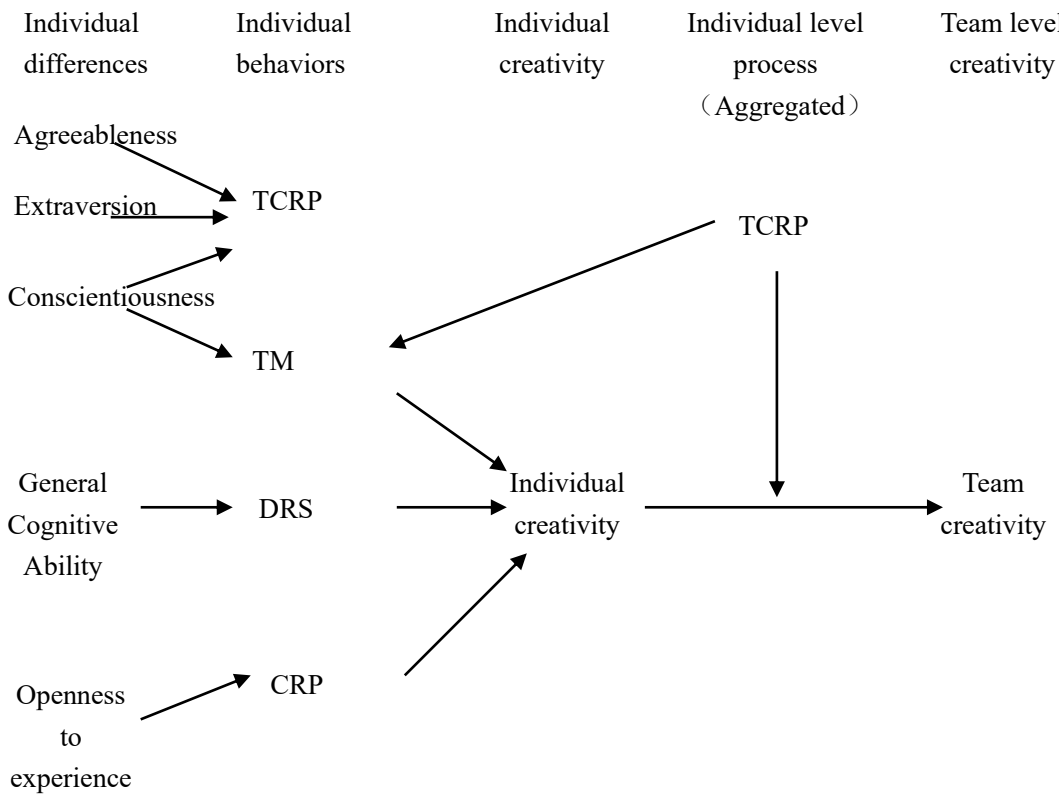


Figure 2.1 An interactionist of organizational creativity

2) Multilevel latent variable model of team creativity. Drawing on the componential theory of creativity, Taggar (2002) established a multilevel model and argued that team creativity depends on individual creativity, cognitive ability, and domain relevant skills (Figure 2.1). At the individual level, Taggar (2002) explored the impact of individual differences (e.g., extraversion, openness to experience) on team process. Results showed that an individual's conscientiousness, extraversion, and agreeableness are positively related to team process (e.g., team creativity-relevant process). In addition, at the team level, team creativity is an interactive function of aggregated individual creativity and the amount of team creativity-relevant processes. That is, team creativity-relevant processes, which include inspirational motivation, coordination, and individualized consideration, moderate the relationship between individual creativity and team creativity.



TCRP=Team creativity-relevant processes TM=Task motivation DRS=Domain-relevant skills CRP=Creativity-relevant process

Figure 2.2 Multilevel latent variable model of team performance on tasks requiring creativity

3) The model of creativity aggregated across individuals and time. Pioral-Merol and Mann (2004) explored the relationship between individual creativity and team creativity. Also, they examined the influence of the work environment on individual creativity as well as team creativity. Results demonstrated that team creativity scores could be explained "statistically by aggregation processes across both people and time" (Pioral-Merol & Mann, 2004: 235). Team creativity at a particular point in time could be explained as either a weighted average or the average of individual creativity, and the creativity of project outcomes can be explained by either the average of or maximum of team creativity across time-points. Drawing on this model, "failure to account for aggregation across time as well as across individuals can result in misleading empirical results, and can result in the erroneous conclusion that team climate influences team creativity directly rather than indirectly via individuals" (Pioral-Merol & Mann, 2004: 235).

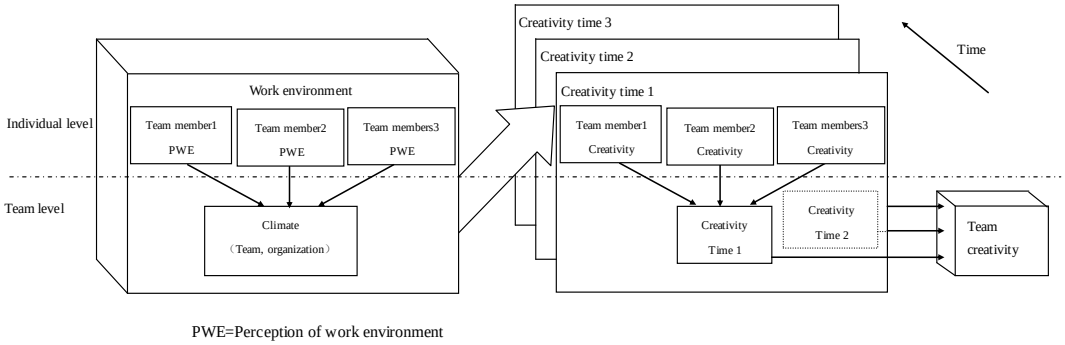


Figure 2.3 Model of creativity aggregated across individual time

In sum, scholars, who believed team creativity is the aggregation of individual creativity, focused on the influence of individual creativity on team creativity.

(2) Integrality model of team creativity. Scholars, who hold the "integrality" view of team creativity, emphasize the influence of social system attribute of team creativity (i.e. Amabile, 1996; West, 2002).

1) Conceptual model underlying assessment of perceptions of the work environment for creativity. Amabile (1996) applied the concepts and methods of social psychology to creativity research. He argued that the "work environment can influence both the level and frequency of creative behavior" (Amabile, 1996: 1155). That is, work environment, which includes encouragement of creativity, autonomy or freedom, resources, pressures, and organizational impediments, is an important influencing factor of team creativity (Figure 2.4).

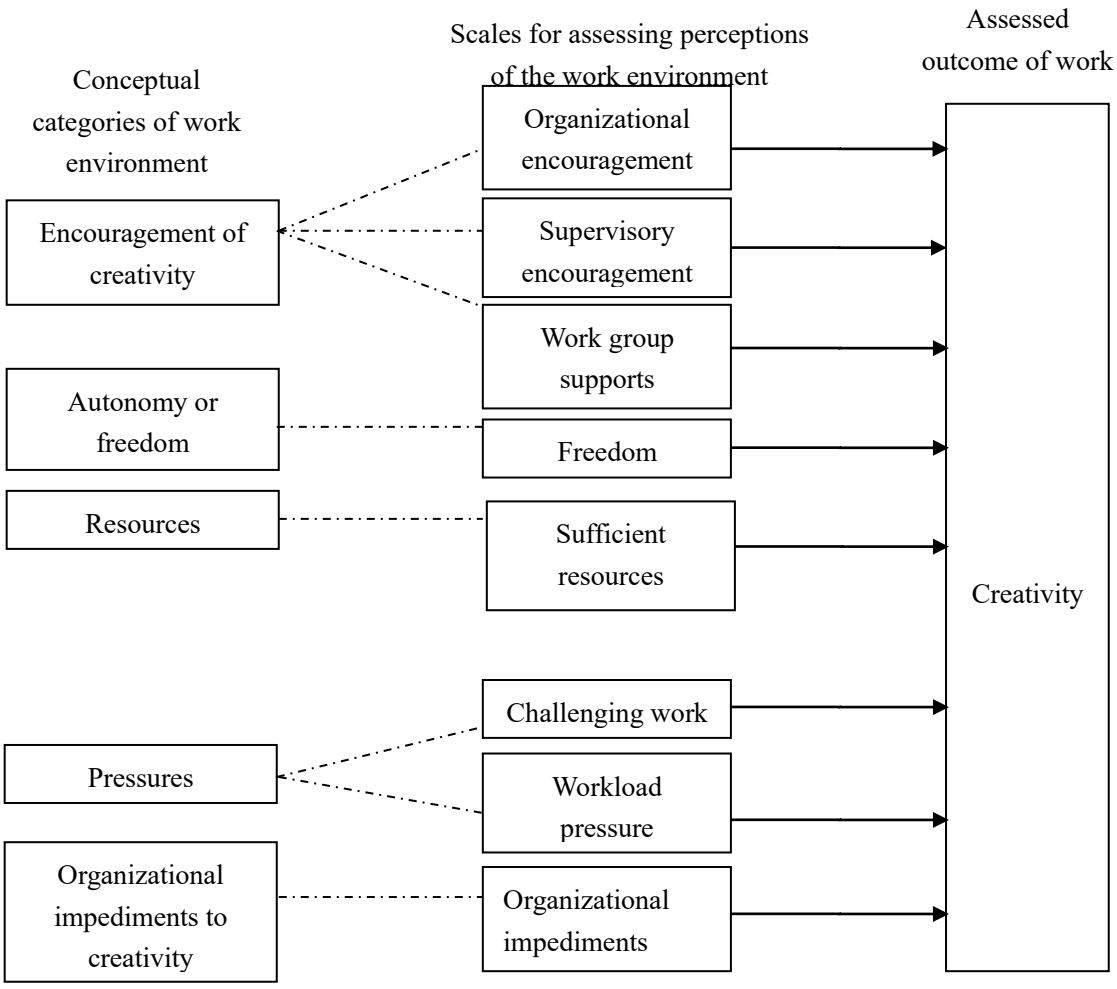


Figure 2.4 Conceptual model underlying assessment of perceptions of the work environment for creativity

2) Creativity and innovation implementation model. West (2002) suggested that "creativity occurs primarily at the early stages of innovation processes with innovation implementation later" (West, 2002: 355). In the model, West (2002) examined the influence of group knowledge diversity and skills, task characteristics, external demands, intragroup safety, and integrating group processes on creativity. Results showed that "diversity of knowledge and skills is a powerful predictor of innovation, but integrating group processes and competencies are needed to enable the fruits of this diversity to be harvested" (West, 2002: 355).

Figure 2.5 Integrating group process in a model of team innovation

In sum, scholars (i.e. Amabile, 1996; West, 2002), who hold the "integrality" view of creativity, mainly focuses on the influence of the interaction between communication and work environment on team creativity (Amabile, 1988; Amabile, 1996; West, 2002). That is, they pay more attention to the influence of task characteristics, knowledge diversity and skills, team process, team climate, and external demands on team creativity.

2.1.2 Influencing factors of team creativity

Recently, scholars have explored the influencing factors of team creativity. In general, the factors that influence team creativity can be divided into individual level factors, team level factors, and organizational level factors.

At the individual level, personality, motivation, cognitive styles, and knowledge skills are important factors that affect creativity.

Personality. Previous research on individual creativity mainly focused on the influence of creative personality on creativity. For example, Kurtzberg and Amabile (2001) explored the influence of team members' characteristics (such as race, nationality, gender, cultural values, and cultural values) on team creativity. Baer et al. (2014) argued that team members' creative personalities are positively associated with team creativity. More specifically, team members with high confidence, extraversion,

and experience openness are more likely to be creative. In addition, Tse, To and Chiu (2018) suggested that creative personality can moderate the relation between transformational leadership and personal control, which in turn will mediate the joint effect on individual creativity.

In addition to creative personality, team heterogeneity is also related to team creativity (Somech & Drach-Zahavy, 2013). For example, Taggar (2002) explored the influence of individual differences in personality (e.g., extraversion, due diligence) on team creativity. Shin and Zhou (2007) showed that "transformational leadership and educational specialization heterogeneity interacted to affect team creativity in such a way that when transformational leadership was high, teams with greater educational specialization heterogeneity exhibited greater team creativity" (Shin & Zhou, 2007: 1709).

Motivation. Previous research has shown that motivation is an important part of creativity. For example, according to componential theory of creativity (Amabile, 1988, 1996), domain-relevant skills, creativity-relevant skills, and task intrinsic motivation are three components of creativity. Task intrinsic motivation, which refers to an individual's work attitude and self-perception of the work, includes intrinsic motivation (e.g., interest, participation degree, and curiosity) and prosocial motivation (Amabile, 1983).

Empirical studies of the motivation and team creativity relationship have yielded inconsistent findings (Shalley & Gilson, 2004). For example, Zhang et al. (2014) argued that intrinsic motivation relates positively to creativity, and fully mediates the relationship between empowering leadership and employee creativity. Also, Shin and Zhou (2003) suggested that intrinsic motivation is positively related to creativity, and it partially mediates the relationship between transformational leadership and individual creativity. However, Shalley and Perry-Smith (2001) argued that intrinsic motivation is not relevant to creativity, and it does not play a mediating role in the relationship between expected evaluation and creativity.

In addition to intrinsic motivation, another stream of motivational research has

viewed creative self-efficacy as an alternative motivational mediating mechanism that linkes contextualand personal factors to creativity. Creative self-efficacy has been shown to be positively related to creativity (Tierney & Farmer, 2002, 2004). For example, creative self-efficacy can mediate the effects of contextual factors (e.g., transformational leadership) on creativity (Gong, Huang, & Farh, 2009; Wang, Tsai, & Tsai, 2004). However, in another research, there is no mediation effect of creative self-efficacy regarding this association (Akinlade, 2014). More recently, prosocial motivation has been regarded as a new motivational construct conducive to creativity (Grant, 2008). For example, Liu, Jiang, Shalley, Keem, and Zhou (2016) found that prosocial motivation is positively related to creativity. However, they mainly focused on individual creativity, and did not examine the relationship between prosocial motivation and team creativity.

Cognitive styles and knowledge skills. Kirton (1976) argued that individuals with innovative cognitive style are considered to be more creative than individuals with adaptive cognitive style. Wang, Kim and Lee (2016) showed that cognitive team diversity is negatively related to team creativity, and intrinsic motivation plays a mediating role in the relationship between cognitive team diversity and team creativity. Further, Anderson et al. (2014) argued that individual knowledge plays an important role in improving individual creativity. That is, team creativity relies on team members' task related knowledge (Leung & Wang, 2015). For example, West's (2002) study showed that team creativity can be influenced by external demand, task characteristics, team diversity, team diverse knowledge, and skills. Furthermore, Han, Han and Brass (2014) argued that the interaction between knowledge diversity and knowledge inconsistency is positively related to team creativity.

(2) Team level factors. At the team level, the factors that influence team creativity mainly include team types, team composition, team size, team phase, team climate, and team interaction.

Team types. Previous studies have shown that closed and open team types may have different effects on team creativity (Shin & Zhou, 2003), because open teams

can accept all proposed ideas by team members with an open mind, and encourage team members to discuss the ideas (Bi, Xi & Wang, 2005). Choi and Thompson's (2005) experimental study also confirmed that in terms of creative fluency and flexibility, team members perform better in open teams than in closed teams.

Team composition. Perry-Smith and Shalley (2014) explored the effect of member nationality-heterogeneous ties outside of the team on team creativity. Results showed that both weak outside ties independently and outside ties with nationality-heterogeneous individuals and facilitate team creativity.

Team size and team phase. Leenders, Van Engelen, and Kratzer (2003) have shown that team life, team size, and team characteristics will influence team creativity. However, either smaller or larger team size is not beneficial to team creativity, because smaller team size has low cognitive diversity which is crucial to team creativity; while larger team size may inhibit knowledge exchange, which in turn will inhibit team creativity (Leenders, Van Engelen & Kratzer, 2003). In addition, in terms of team phase, Farh, Lee and Farh (2010) argued that the relationship between task conflict and creativity can be moderated by team phase, and the curvilinear effect was strongest at an early phase.

2) Team climate. According to West and Anderson (1996), team climate, which mainly includes team goal, participation safety, mission-orientation, innovation support, and interaction frequency, can influence team creativity. For example, Luo et al. (2016) found that team goal orientation has a positive effect on individual and team creativity. Also, Gong et al. (2013) showed that when team members have shared goals and commitments, they are more likely to accept different opinions, which in turn will prompt team creativity.

3) Team interaction. Team creativity may be influenced by team interaction. For example, Kim and Shin (2015) argued that positive emotions can promote team trust and team creativity (Kim & Shin, 2015; Tang & Naumann, 2017). However, the interaction between trust and positive emotions may inhibit team creativity. More specifically, team positive emotion can prompt team creativity in low team trust,

however, team positive emotion negatively related to team creativity in high team trust. In addition, Zhao (2015) examined the relationship between task conflict and team creativity. Results demonstrated that general team conflict negatively related to team creativity. However, different types of conflict may have different effects on creativity. For example, Baer et al. (2014) argued that relationship conflict will inhibit team creativity, while task conflict will facilitate team creativity.

(3) Organizational level factors. At the organizational level, the factors that influence team creativity mainly include organizational culture and leadership style (Amabile, 1997).

Organizational culture. Organizational cultural diversity and distance can influence team creativity. For example, Leung and Wang (2015) argued that cultural diversity can inhibit team creativity, and knowledge heterogeneity and perspective heterogeneity play important mediating roles in the relationship between cultural diversity and team creativity. Moreover, task characteristics and information exchange play important mediating roles in the relationship between cultural diversity and team creativity. Yuan and Zhou (2015) showed that cultural distance can influence team divergence and team aggregation, which in turn will influence team creativity.

Leadership. To date, many scholars have explored the relationship between leadership such as transformational leadership, paternalistic leadership, charismatic leadership, authentic leadership, empowering leadership, ambidextrous leadership and creativity (i.e. Chow, 2018; Kim & Lee, 2016; Luo, Men & Zhong, 2014; Shin & Zhou, 2007; Wang, Zhang, Tsui & Wang, 2011). For example, Khalili (2016) argued that leadership is crucial to team innovation and team creativity, and transformational leadership is positively related to team creativity and innovation. Moreover, psychological safety, psychological empowerment, and creative self-efficacy play important mediating roles in the relationship between transformational leadership and team creativity. Dedahanov et al. (2016) explored the effect of paternalistic leadership on team creativity. Results showed that paternalistic leadership is positively related to team creativity, and team psychological empowerment plays a full mediating role in

the relationship between paternalistic leadership and team creativity.

2.1.3 Summary of team creativity

Prior work has suggested that individual creativity is the basis of team creativity (Drazin et al., 1999; Gong et al., 2016). Recently, scholars have begun to consider the influence of team composition, team interaction, team climate, task characteristics, leadership, and team internal resources and management on team creativity. More recently, knowledge acquisition such as external knowledge search and internal knowledge sharing has been conceptualized and verified as an important construct conducive to creativity (Huang et al., 2014, Soo et al., 2007). However, little attention has been paied to investigate the underlying influence processes, leaving unclear how external knowledge search and knowledge sharing shapes team creativity.

2.1.4 Team creativity and knowledge acquisition

In this highly competitive era, firms face dynamic environments which is characterized by rapid technological change and intense competition (Daniele, 2008; Farh et al., 2010), and there are increasingly frequent calls to pursue creativity and innovation as a source of competitive advantage in highly competitive and rapidly changing environments (Ford & Gioia, 2000).

Subramaniam and Youndt (2005) argued that in the era of knowledge economy, knowledge, which will replace capital, equipment, materials, and labor, has become an important factor that influence the creative ability of enterprises. Thus, knowledge acquisition will play a crucial role in creativity and innovation. However, to date, little research has explored how knowledge acquisition affects team creativity (Anderson, Poto Nik & Zhou, 2014), and it has become an urgent problem to be solved by scholars. Liu & Dang (2013) argued that knowledge acquisition mainly includes external knowledge search and internal knowledge sharing, and they found that both external knowledge search and internal knowledge sharing are positively related to

radical innovation. Recently, some scholars have explored the relationship between knowledge acquisition and team creativity. For example, Huang et al., (2014) explored the relationship between internal knowledge sharing and creativity. Results showed that team members with expertise dissimilar to that of their colleagues may exhibit creativity when team members engaged in higher levels of tacit knowledge sharing rather than explicit knowledge sharing. By contrast, team members whose expertise is similar to that of their colleagues are more likely to exhibit creative behavior when team members participate in higher levels of explicit knowledge sharing rather than tacit knowledge sharing.

Also, some scholars have examined the influence of external knowledge search on creativity. For example, Soo et al. (2007) explored the effects of external knowledge search on creativity and organizational learning. Geng, Liu and Shen (2012) examined the influence of external knowledge search on organizational creativity. Results showed that market orientation has an inverted U-shaped relationship with organizational creativity; entrepreneurial orientation has a positive effect on organizational creativity; market and technical knowledge acquisition relate positively to organizational creativity. Also, Bai, Liu and Han (2014) argued that market and technical knowledge search can positively influence organizational creativity. In addition, market knowledge search can prompt technical knowledge search.

In sum, in the era of knowledge economy, in order to enhance team creativity, it is not enough for organization to solely depend on internal knowledge. Organizations also need cross organizational boundaries to acquire knowledge from outside. Thus, it is an important way to enhance team creativity by combining internal knowledge and external knowledge. More specifically, to remain competitive in knowledge-intensive context and to respond to the dramatically changing market demands, organizations rely more heavily on utilizing both internal knowledge and external knowledge to prompt creativity and innovation (Fabrizio, 2014; Kogut & Zander, 1992).

2.2 Research on knowledge acquisition

2.2.1 Definition of knowledge acquisition

Recently, scholars have defined knowledge acquisition from the perspective of knowledge types and knowledge sources. For example, Rebuschat and Williams (2012) argued that knowledge acquisition can be divided into explicit knowledge acquisition and tacit knowledge acquisition. Knowledge acquisition refers to translating organized documents and data (explicit knowledge) and expert skills existing in the human brain (tacit knowledge) into reusable and retrieval knowledge. However, Grimpe and Kaiser (2010) defined knowledge from the perspective of knowledge sources, and he divided knowledge into external knowledge and internal knowledge. Further, Marco-Lajara et al. (2016) defined knowledge acquisition from the perspective of knowledge sources, and they divided knowledge sources into internal knowledge sources and external knowledge sources. External knowledge is mainly acquired from customers, suppliers, competitors, and partners, and the main way to access internal knowledge is internal knowledge sharing (Ding, 2013). Specifically, knowledge can be acquired from outside (Laursen & Salter, 2006), such as market (e.g., suppliers of equipment, materials, components, or software; clients or customers; competitors; consultants; commercial laboratories; R&D teams), research institution (e.g., universities, private research institutes). Also, team members can share and transfer knowledge through a variety of communication media and methods (Huang et al., 2014; Wang & Noe, 2010). Thus, we define knowledge acquisition as the process of obtaining reusable and retrieved knowledge from both internal knowledge source and external knowledge source. That is, knowledge acquisition mainly includes external knowledge search and internal knowledge sharing (Cassiman & Veugelers, 2006; Huang et al., 2014).

2.2.2 External knowledge search: One way to acquire external knowledge

2.2.2.1Definition of external knowledge search

External knowledge search derives from the word “innovative search” (Nelson & Richard, 1995), which refers to producing new technology by exploiting existing knowledge. Huber (1991) argued that the external knowledge search in the organization is an important part of organizational learning, and it can help employees to solve potential problems in the enterprise. Jaikumar and Bohn (1992) suggested that the goal of external knowledge search is to find a better manufacturing method. Recently, Katila and Ahuja (2002) has defined knowledge search as “organization’s problem-solving activities that involve the creation and recombination of technological ideas” (Katila and Ahuja, 2002: 1184). Laursen and Salter (2006) argued that “search processes involve investments in building and sustaining links with users, suppliers, and a wide range of different institutions inside the innovation system” (Laursen & Salter, 2006: 134). Wu and Chen (2015) defined external knowledge search as a controlled, active monitoring, and cognitive activities. Based on previous study, Zhang and Liu (2014) defined external knowledge search as an activity that an organization relies on internal and external channels to acquire technological knowledge from customer and market to solve innovative problems.

2.2.2.2 Dimension of knowledge search

(1) According to geographical distance, Martin and Mitehell (1998) developed the concepts of local search and remote search as two subsets of external knowledge search. They argued that “local search will lead most product market incumbents that introduce second or subsequent designs after their entry to introduce designs that are similar to those incorporated in their existing products” (Martin & Mitehell, 1998: 753). And remote search refers to an international and global search activity, which occurs in a wider geographical scope. A firm needs to cross the organization boundary to search new knowledge, which is beneficial for radical innovation. Similarly, Wu

and Chen (2016) divided knowledge search into international search and local search.

(2) Based on search behavior characteristics, Katila and Ahuja (2002) developed the concepts of external search breadth—the number of external sources or search channels, and external search depth—the extent to which organizations draw deeply from different external sources or search channels. Zhao and Li (2016) argued there is a competitive relationship between external search depth and search breadth, and an organization needs to take appropriate measures to balance the competitive relationship.

(3) According to knowledge sources, Garcia-Granero, Vega-Jurado and Alegre (2014) divided external knowledge search into exploitative knowledge search and exploratory knowledge search. Exploitative knowledge search stresses using the original knowledge of the organization, while explorative search focuses searching new knowledge of the organization. Grimpe and Sofk (2009) divided external knowledge search into market knowledge search and technical knowledge search. Market knowledge search is to search knowledge from customers, competitors, and suppliers; Technical knowledge search refers to searching technology and related knowledge across the corporate boundaries.

2.2.2.3 Influencing factors of external knowledge search

(1) Internal sources (i.e. resource redundancy, competitive strategy). Barney (1991) argued that organizational resource is a foundation for companies to maintain a competitive advantage. Katila and Ahuja (2002) argued that when organizations have redundant resources, managers are more likely to encourage employees to search for new knowledge, which in turn will prompt innovation. However, due to the existence of uncertainty in cross-border search, managers are less likely to encourage employees to search for new knowledge for innovation (Nohria, 1996).

Similarly, Danneels' (2008) empirical research showed that resource redundancy has an inverted U-shaped relationship with knowledge search. Further, Li, Fan and Zheng (2015) argued that unabsorbed redundant resources are positively related to

informal search width and formal search width, while absorbed redundant resources are positively related to informal search width.

Strategy. Firms typically use cost leading strategy, diversity strategy, and goal integrating strategy to maintain their competitive advantage. Cohen and Levinthal (1990) argued that R&D involves high risk, and firms should weigh the risk and benefit when they focus on external knowledge search. In addition, Zhao and Li (2016) argued that, in manufacturing industry, cost leading strategy will inhibit external knowledge search, and diversity strategy will prompt external knowledge search. Because when firms emphasize diversity strategy, heterogeneous knowledge acquired through external knowledge search will provide support for innovation.

(2) Environments. Scholars have divided external environments into the market environments and technical environments. Prior work showed that environments are important external factor that affect external knowledge search. For example, Pisano (1990) argued that, in order to maintain or enhance exclusivity in a competitive market environment, firms are inclined to exploit internal knowledge; and in a weak competitive environment, firms are likely to search external knowledge. However, some scholars have inconsistent views. For example, Sidhu, Volberda and Commandeur (2004) argued that environmental dynamism has a significant effect on external knowledge search, and it determines an organization's knowledge search method. More specifically, in dynamic market environments, organizations are more likely to search knowledge from the supplier. However, in stable market environments, organizations are more likely to search knowledge from the consumer. In addition, Zhao and Li (2016) suggested that technical uncertainty negatively moderates the relationship between search breadth and radical innovation and positively moderates the relationship between search depth and radical innovation

In summary, research on the influencing factors of external knowledge search mainly focuses on the internal resources and external environment, and it is at the organizational level. However, to date, little research has explored the influencing factors of external knowledge search at the individual level and team level.

2.2.2.4 The effects of knowledge search

External knowledge search and innovation. Soo et al. (2007) explored the relationship between external knowledge search on creativity, as well as its impact on learning. Results showed that external knowledge search is positively related to individual creativity. Gallego, Rubalcaba and Suárez (2013) found that external knowledge search can influence innovation performance through innovative strategies. Also, Mina, Bascavusoglu-Moreau and Hughes (2014) argued that external knowledge search has an important effect on opening innovation. However, Wu and Chen (2015) examined the relationship between external knowledge search and product innovation, and he found that there is a non-linear relationship between external knowledge search width and product innovation. Hu (2013) suggested that external knowledge search plays a mediating role in the relationship between network location and innovation performance. Further, Feng and Chen (2015) took small and medium-sized micro-enterprises as an example to explore the influence of external knowledge search on collaborative innovation. Results showed that market knowledge search and technical knowledge search can improve cooperative innovative ability, and knowledge integration plays a mediating role in the relationship between knowledge search and innovative ability. In addition, Li and Zhao (2016) found that external knowledge search depth is positively related to radical innovation.

External knowledge search and performance. Jang and Nemeh (2017) examined the relationship between Salespeople knowledge search behavior and sales performance. Results showed that instead of conducting a horizontal search across competing brands broadly, salespeople should center on a vertical knowledge search for proximate competitors' products to imrove performance. Ferreras-Méndez et al. (2015) explored the relationship between external knowledge search and corporate performance. Results showed that external knowledge search can not only prompt innovation, but also improve firm performance. However, Cruz-González, López-Sáez and Navas-López (2015) suggested that the influence of external knowledge search on firm performance depends on the technological turbulence.

More specifically, in lowly dynamic environments, external knowledge search width is positively related to performance. While in highly dynamic environments, external knowledge search depth positively influences performance.

2.2.2.5Measures of external knowledge search

There are two ways to measure external knowledge search: One is to use objective quantitative indicators to measure external knowledge search; the other is to use questionnaire survey to measure external knowledge search.

(1) Measured by objective quantitative indicators

Jung and Lee (2016) conceptualized "firm search types with two distinct dimensions—search target and search boundary—and propose contrasting effects of the search boundary in which firms search prior original knowledge on the propensities for firms to create path-breaking novelties and high impact breakthroughs" (Jung & Lee, 2016: 1725). To measure the intensity of original search, they used counts of first-ever combined subclass pairs in the cited patents. In addition, to construct a continuous measure of search boundary, they used the technological proximity between the focal patent and the cited patents.

Search proximity=$F'_iF_j/[(F'_iF_i)^{1/2}(F'_jF_j)^{1/2}]$

"Fi is the dimension vector representing the USPTO patent classes of the focal patent i and Fj is the vector representing the patent classes of all patents j cited by patent I" (Jung & Lee, 2016: 1735).

(2) Questionnaires. According to Laursen and Salter (2006), external knowledge sources includes market (e.g., Suppliers of equipment, materials, components, or software; clients or customers; competitors; consultants; commercial laboratories/ R&D enterprises), institutional (e.g., universities or other higher education institutes; government research organizations; other public sector; private research institutes), others (e.g., professional conferences, meetings; trade associations; technical/trade press, computer databases; fairs, exhibitions s), and specialized (e.g., technical standards; health and safety standards and regulations; environmental standards and

regulations). Breadth refers to a combination of the 16 sources of information or knowledge for innovation. At first, each of the 16 sources are coded as a binary variable, 1 being use of the given knowledge source and 0 being no use of the given knowledge source. Subsequently, the 16 sources are simply added up so that an organization gets the value of 0 when no knowledge sources are used, while an organization gets a score of 16, when all knowledge sources are used. Accordingly, depth is constructed using the same 16 sources of knowledge as those used in constructing breadth. In this case each of the 16 sources are coded with 1 when the firm in question reports that it uses the source to a high degree and 0 in the case of no, low, or medium use of the given source. As in the case of breadth, the 16 sources are subsequently added up so that an organization gets the value of 0 when no knowledge sources are used to a high degree, while an organization gets a score of 16 when all knowledge sources are used to a high degree (Laursen & Salter, 2006).

Eriksson et al. (2016) developed an eight-item scale, which includes exploratory knowledge search and explorative knowledge search. The Cronbach's alpha coefficient for exploratory knowledge search was 0.85, and the Cronbach's alpha coefficient for explorative knowledge search was 0.67.

Based on Laursen and Salter (2006), Hu and Fang (2013) designed a scale to measure external knowledge search in Chinese context, and they divided external knowledge search into knowledge search depth and knowledge search width.

2.2.2.6 Summary of external knowledge search

Although previous studies have explored the definition, measurement, and influencing factors and effects of external knowledge search, there are still some limitations.

(1) External knowledge search plays a very important role in improving creativity and innovation performance.Although prior work has examined the relationship between external knowledge search and individual creativity (Soo, et al, 2007), however, to our knowledge, little research has explored the relationship

between external knowledge search and team creativity, leaving unclear how external knowledge search affects team creativity.

(2) Although many researchers have explored the influencing factors of external knowledge (Jung & Lee, 2016). However, they mainly focus on the influencing factors at the organizational level. Littlte research has explored the influencing factors of external knowledge search at both the individual level and team level.

2.2.3 Internal knowledge sharing: One way to acquire internal knowledge

2.2.3.1 Definition of internal knowledge sharing

Researchers have defined internal knowledge sharing from the perspective of process, behavior, effect, and intention.

Knowledge sharing process. Knowledge sharing was firstly introduced by Senge (1997). He argued that knowledge sharing is an individual's ability to help others to develop effective behaviors. Also, he argued that knowledge sharing includes two processes. One is to transfer knowledge to others. The other is to help others to understand the information.

Nonaka and Takeuchi (1995) defined knowledge sharing from the perspective of knowledge transformation, and they argued that internal knowledge sharing is to translate tacit knowledge into explicit knowledge. Wang and Noe (2010) argued that knowledge sharing is to provide information and skills to help individuals to solve problems and generate new ideas. Similarly, Liu and Phillips (2011) argued that knowledge sharing is to transfer knowledge, data, information, ideas, and experience between knowledge owners and knowledge recipients.

(2) Knowledge sharing behaviors. Connelly and Kelloway (2003) defined knowledge sharing as a collective behavior that includes knowledge exchange and knowledge donation. Wang (2004) argued that knowledge sharing is an ethical behavior, and it can help individuals to share their experience and information with their coworkers. In addition, according to Zhao, Zhao and Liao (2016), knowledge

sharing is a voluntary altruistic behavior, and it can be realized through social exchange mechanism.

(3) Knowledge sharing effects. Davenport and Prusak (1998) argued that knowledge sharing not only includes the effect of the communication between knowledge owners and knowledge recipients, but also includes the effect of knowledge digestion and absorption. Han and Chen (2016) extended knowledge sharing to the organizational level. They argued that knowledge sharing refers to the effect of expanding knowledge values and generating new knowledge through formal and informal channels among enterprises within the cluster, and it can be realized through exchange, discussion, digestion, absorption, and transformation.

(4) Knowledge sharing intention. Bock et al. (2005) argued that knowledge sharing refers to "the willingness of individuals in an organization to share with others the knowledge they have acquired or created" (Bock et al., 2005: 88). Similarly, Huang et al. (2014) defined knowledge sharing as the willingness of individuals in the workplace to share their work-related expertise, experience, and opinion with colleagues. Similarly, Lu and Chen (2012) argued that knowledge sharing is an intention to share their own knowledge with colleagues and help others to learn new knowledge. In addition, Jin (2013) argued that knowledge sharing refers to the willingness and motivation to share knowledge with others.

2.2.3.2Measures of internal knowledge sharing

There are two main methods to measure internal knowledge sharing: One is to measure internal knowledge sharing through a case study or an experimental study; the other is to measure internal knowledge sharing through questionnaires.

(1) Case study or experimental study. Chow et al. (2000) used a case study to explore the influence of culture on employees' knowledge sharing, and he measured knowledge sharing intention with a single question. Also, Miller and Karakowsky (2005) adopted experimental study to measure knowledge sharing, in his study, he measured knowledge sharing with a simple question—whether team members want

feedback from others about their task accomplishment.

(2) Questionnaires

Hult, Ketehen and Slater (2004) divided knowledge sharing into knowledge acquisition (Cronbach α=0.86) and knowledge division (Cronbach α= 0.93); Huang et al. (2014) measured knowledge sharing with a five-item scale including explicit knowledge sharing and tacit knowledge sharing. In addition, Chiu, Hsu and Wang (2006) divided knowledge sharing into knowledge sharing quality and knowledge sharing quantity from the perspective of knowledge sharing effects.

2.2.3.3 The influencing factors of internal knowledge sharing

The influencing factors of internal knowledge sharing include knowledge characteristics, individual factors, organizational factors, and cultural factors.

(1) Knowledge characteristics. Knowledge can be divided into explicit knowledge and tacit knowledge (Polanyi, 1967). Tacit knowledge is subjective knowledge that is difficult to formalize, articulate, and communicate with others, such as personal experiences, professional insights, and know-how in a specific area. Explicit knowledge refers to objective knowledge that can be articulated, codified, and expressed in formal and systematic language, such as documents, reports, and models (Nonaka, Toyama & Konno, 2000). Compared with tacit knowledge, explicit knowledge is easier to be transferred (Zander & Kogut, 1995). Hippel (1994) argued that the difficulty of knowledge sharing lies in the viscosity of knowledge. Also, Szulanski (1996) argued that knowledge viscosity is an important factor that affects knowledge sharing within an enterprise. Based on previous research, Cummings and Teng (2003) argued that embeddness is an important situational factor that influences knowledge sharing. In addition, Ipe (2003) found that the value of knowledge plays an important role in knowledge sharing. More specifically, employees would not like to share vital knowledge which is related to their status, career prospects, and personal reputation.

(2) Individual factors.

Personality. Hamel (1991) argued that knowledge sharing can be influenced by coworkers' learning intent, motivation, and the ability to transfer and receive knowledge. Kurt et al. (2008) examined the relationship between personality and knowledge sharing, and they found that agreeableness can influence interpersonal trust, which in turn will influence knowledge sharing. Matzler and Mueller (2011) explored the influence of agreeableness, conscientiousness, and openness on knowledge sharing. Wang and Yang (2007) showed that agreeableness, extraversion, and conscientiousness are positively associated with individuals' intention to share. In addition, Anwar (2017) examined the relationship between personality and knowledge sharing. Results showed that openness to experience, conscientiousness, extraversion, and agreeableness are positively related to knowledge sharing. However, neuroticism is negatively related to knowledge sharing.

Self-efficacy. Bock et al. (2005) argued that self-efficacy can influence subjective norms, which in turn will prompt knowledge sharing. Also, Chowdhury (2007) found that there is a positive relationship between self-efficacy and knowledge sharing.

Intrinsic motivation. Lin (2007) explored the effects of intrinsic and extrinsic motivation on individuals' knowledge sharing behavior. Results showed that results showed that motivational factors such as knowledge self-efficacy, reciprocal benefits, and enjoyment in helping others are significantly related to employees' knowledge sharing attitudes and intentions. By contrast, expected organizational rewards are not significantly related to employees' knowledge sharing attitudes and intentions. Also, Chen et al. (2018) identifed and explained the role of individuals' motivation and awareness in prompting knowledge sharing in the real workplace. Results showed that the motivation for kowledge sharing is significantly associated with awareness by managers and developers of the benefits of knowledge sharing in their professional practice. In addition, previous research has suggested that greediness can inhibit knowledge sharing (Lu, Leung & Koch, 2006), while cooperation prompts knowledge sharing (Lin, 2007).

Trust. Szulanski, Cappetta and Jensen (2004) explored the effect of interpersonal

trust on knowledge sharing, and they found that interpersonal trust is positively related to knowledge sharing. Also, Mansour et al. (2014) examined the relationship between interpersonal trust and knowledge sharing. However, they found that affective trust can influence the knowledge sharing behavior, while cognitive trust is not related to knowledge sharing behavior. In addition, Chowdhury (2005) argued that cognitive trust and affective trust are positively related to knowledge sharing. Also, Wang and Yang (2012) found that trust and team interactions play important roles in knowledge sharing. More specifically, affective trust is positively related to explicit knowledge sharing, and cognitive trust is positively related to tacit knowledge sharing.

(3) Organizational (team) factors

Team (organizational) climate. Previous studies have shown that organizational climate is positively related to knowledge sharing (Matic et al., 2017). For example, Zarraga and Bonaehe (2003) explored the influence of team climate on knowledge sharing. Results showed that high care climate such as active empathy and free expression is positively related to knowledge transfer and knowledge sharing. Also, Bock et al. (2005) found that employees' perception of the organizational climate can influence knowledge sharing. Similarly, Radaelli et al. (2011) examined the relationship between knowledge sharing climate and knowledge sharing. Results showed that knowledge sharing climate is positively related to knowledge sharing. In addition, Wang, Xu and Peng (2011) argued that relationship perception and creative atmosphere will prompt knowledge sharing.

Leadership. Bryant (2003) found that transformational leadership is positively related to knowledge sharing, while transactional leadership is positively related to knowledge development. Zarraga and Bonach (2003) argued that participation leadership can prompt team communication, which in turn will prompt knowledge sharing. Also, Li, Xi and Liu (2014) suggested a positive relationship between transformational leadership and knowledge sharing climate. However, Zhang, Zhang, Zhang and Zhang (2015) argued that different types of leadership may have different

effects on knowledge sharing. More specifically, authoritarian leadership can inhibit tacit knowledge sharing, while empowering leadership can prompt tacit knowledge sharing. In addition, Li, Tian and Sun (2015) found that self-sacrificing leadership is positively related to knowledge sharing.

Incentive system. Chang and Liao (2011) argued that team performance appraisal is not directly related to knowledge sharing. More specifically, team performance appraisal can influence interpersonal trust and team commitment, which in turn will influence knowledge sharing. In addition, procedural justice and interaction justice played moderating roles in the relationship between team performance appraisal and knowledge sharing. Also, Quigley, Tesluk and Locke (2007) argued that compared with individual incentive, team incentive has a stronger relationship with knowledge sharing. Similarly, Zhang and Zhu (2012) found that rewards can prompt knowledge sharing. In addition, Zhang et al. (2017) found that material incentive is positively related to individuals' knowledge sharing intention. More specifically, intrinsic incentive can influence knowledge sharing intention through individuals' behavior, and extrinsic incentive can influence knowledge sharing intention through individuals' subjective norms.

(4) Culture. Culture is an important factor that influences knowledge sharing. For example, Ruppel and Harrington (2001) found that innovative culture is positively related to knowledge sharing. Also, Lyu and Zhang (2017) argued that support and congruent organisational culture is positively related to internal knowledge sharing.

2.2.3.4The effects of internal knowledge sharing

Internal knowledge sharing and performance. Srivastava, Bartol and Locke (2006) explored the relationship between empowering leadership and team performance. Results showed empowering leadership is positively related to team performance, and knowledge sharing plays a mediating role in the relationship between empowering leadership and team performance. Alsharo, Gregg and Ramirez (2017) examined how knowledge sharing and trust affect team effectiveness. Results showed that knowledge

sharing can influence trust and collaboration among virtual team members, which in turn will influence team effectiveness. Also, Staples and Webster (2008) found that team knowledge sharing positively affects team effectiveness. Task interdependence and team virtualization play moderating roles in the relationship between team knowledge sharing and team performance. In addition, Ali, Ul Musawir and Ali (2018) suggested that knowledge sharing and knowledge governance are important antecedents for improving the absoptive capacity of the project, which in turn will improve project performance. However, Cummings (2004) has suggested that knowledge sharing will be affected by other factors, and knowledge sharing is not positively related to performance. Also, Berman, Down and Hill (2002) argued that there is an inverted U-shaped relationship between knowledge sharing and team performance.

Internal knowledge sharing and innovation. Previous research has shown that internal knowledge sharing is positively related to innovation. For example, Al-Husseini and Elbeltagi (2018) examined the relationship between knowledge sharing and product and process innovation in private and public Higher Education (HE) Institutions in Iraq. Results showed that knowledge sharing plays a crucial role in improving innovation in both sectors. Also, Liu and Phillips (2011) found that knowledge sharing intention is positively related to organizational innovation. Moreover, knowledge sharing intention plays a mediating role in the relationship between transformational leadership and team innovation. Curado et al. (2017) found that knowledge sharing plays an important role in innovation, and absorptive capacity plays a mediating role in the relation between knowledge sharing and innovation. Dong et al. (2017) examined the relationship between transformational leadership and team creativity. Results showed that individual-focused transformational leadership can influence individual creativity through individual skill development, whereas team-focused transformational leadership will influence team creativity partially through its effect on team knowledge sharing. Geng, Liu and Shen (2012) argued that goal orientation is positively related to team creativity, and knowledge sharing and

team reflexivity play mediating roles in the relationship between goal orientation and team creativity. In addition, Wang et al. (2014) found that social network is positively related to team creativity, and knowledge sharing plays a mediating role in the relationship between social network and team creativity.

2.2.3.5 Summary of internal knowledge sharing

(1) To date, the influencing factors of knowledge sharing have been paid attention by scholars. Although most research on knowledge sharing focuses on empirical studies, little attention has been given to systematically examining the trigger factors of knowledge sharing through case studies. Consequently, in this study, we will explore the trigger factors of knowledge sharing through case studies.

(2) Recently, scholars have begun to explore the moderating role of knowledge sharing. For example, Huang et al. (2014) investigated whether team-level knowledge sharing moderates the relationship between expertise dissimilarity and individual creativity in R&D teams. According to Lu (2015), exploring the moderating role of knowledge sharing will have great potentials. Thus, in this study, we will explore the moderating role of knowledge sharing.

(3) Although it has been long recognized that knowledge sharing has critical implications for team creativity, little attention has been given to systematically examining the effects of knowledge sharing on team creativity (Henderson et al., 2009). Thus, in this study, we will explore how knowledge sharing affects team creativity.

2.3 The influencing mechanism of knowledge acquisition: Double mechanisms framework

In highly dynamic environments, it becomes difficult to rely solely on either internal knowledge sharing or external knowledge search to innovate. In order to comprehensively prompt creativity and create a sustainable competitive advantage,

organizations should engage in knowledge-acquisition collaborations. Accordingly, in this study, we will explore how external knowledge search and internal knowledge sharing affect team creativity.

2.3.1 Double mediating mechanisms: Absorptive capacity and knowledge integration

In examining the relationship between knowledge acquisition(including external knowledge search and internal knowledge sharing) and team outcome, previous research has rarely included emergent state and team process concepts simultaneously in their models(Liao et al., 2007; Bao, Xu & Zhang, 2016), though both categories of mediating mechanisms are important (Kearney, Gebert & Voelpel, 2009). The relationship between knowledge acquisition and outcome can be fully understood by considering both the emergent states perspective and the processes perspective. Marks, Mathieu and Zaccaro (2001) emphasized that emergent states are different from team processes, noting that emergent states are "cognitive, motivational, and affective states of teams" (Marks et al., 2001: 357), but team processes refer to "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing task work to achieve collective goals" (Marks et al., 2001: 357). Thus, it is important to explore the mediating mechanism from both the emergent states perspective—absorptive capacity and the processes perspective—knowledge integration.

2.3.2 Absorptive capacity: From the emergent states perspective

2.3.2.1 Definition of absorptive capacity

Absorptive capacity refers to a dynamic organizational capability to value, assimilate, and apply new knowledge (Cohen & Levinthal, 1990), and it is a function of the accumulated prior knowledge. Mowery and Oxley (1995) argued that absorptive capacity is a collection of skills which can help firms to deal with the

hidden knowledge. Based on previous studies, Zahra and George (2002) defined absorptive capacity as "a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability" (Zahra & George, 2002: 186). In this study, absorptive capacity was divided into potential absorptive capacity and realized absorptive capacity. Further, potential absorptive capacity that encompasses knowledge recognition and knowledge assimilation capabilities focuses on knowledge exploration, while realized absorptive capacity centers on knowledge transformation and exploitation (Jansen, Van den Bosch & Volberda, 2005). Lane, Koka and Pathak (2006) suggested that absorptive capacity is a firm's ability to utilize external knowledge through three sequential processes: "Recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning; assimilating valuable new knowledge through transformative learning; using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning" (Lane et al., 2006: 856). In addition, Lichtenthaler (2009) defined absorptive capacity as a firm's ability to explore external knowledge. It includes the process of acquiring, assimilating, and incorporating external knowledge into a firm's knowledge base (Lane et al., 2006; Zahra and George, 2002). In addition, Wang and Yang (2009) defined absorptive capacity as the process of identifying, learning, digesting, and understanding new knowledge and applying it to a specific business environment. Luo (2015) suggested that absorptive capacity is a dynamic ability, and it should be accompanied with the development of a firm's technology.

2.3.2.2 Measures of absorptive capacity

There are two ways to measure absorptive capacity: One way is to use R&D strength, spending, and patent to measure absorptive capacity. For example, Cohen and Levinthal (1990) used R&D intensity to measure absorptive capacity. George et al. (2001) used R&D expenditure and patent number to measure absorptive capacity; the other way is using questionnaire to measure absorptive capacity. For example, Jansen et al. (2005) advanced studies on absorptive capacity by extending and empirically

validating the conceptual distinction between realized and potential absorptive capacity (Zahra & George, 2002). Realized absorptive capacity includes knowledge transformation (Cronbach's α=0.79) and exploitation (Cronbach's α=0.76); Potential absorptive capacity includes knowledge recognition (Cronbach's α=0.72) and assimilation (Cronbach's α=0.71) (Zahra & George, 2002).

2.3.2.3 Influencing factors of absorptive capacity

(1) Individual factors. Bower and Hilgard (1991) argued that the accumulation of individual prior knowledge can not only improve the ability to acquire new knowledge, but also improve the ability to use new knowledge. Cohen and Levinthal (1990) suggested that absorptive capacity is a function of individual prior knowledge such as basic skills and technological knowledge. Similarly, Nooteboom et al. (2007) argued that individual knowledge is an important factor that influences absorptive capacity. Matusik and Heely (2005) also argued that absorptive capacity is related to individual prior knowledge.

(2) Organizational factors. Lane and Lubatkin (1998) explored the relationship between R&D investment and absorptive capacity. Results showed that organizational structure has a greater effect on absorptive capacity than R&D investment. Similarly, Van den Bosch, Volberda and Boer (1999) argued that absorptive capacity depends not only on prior knowledge but also on organizational structure. Also, Zhang, Liu and Peng (2012) explored the effect of organizational structure on absorptive capacity and innovation performance. Results demonstrated that centralization, feedback speed, and departmental integration are positively related to absorptive capacity. Lane, Koka and Pathak (2006) divided the influencing factors of absorptive capacity into external trigger factors and internal trigger factors. The internal trigger factors include the characteristics of organizational mental model, organizational structure, and business strategy. In addition, Lv and Zhao (2014) used grounded theory to explore the influencing factors of absorptive capacity. Results showed that prior knowledge and experience, knowledge source attribute, and innovation network can influence potential absorptive capacity; R&D investment, management, and organizational

learning can influence realized absorptive capacity.

(3) Other factors. Zahra and George (2002) argued that external knowledge, knowledge complementarity, and past experience are important influencing factors of potential absorptive capacity. Jansen, Van den Bosch and Volberda (2005) explored the factors that influence potential absorptive capacity and realized absorptive capacity, and they found that cross-functional interfaces, participation in decision-making, and rotation are related to potential absorptive capacity; while connectivity and socialization are related to the realized absorptive capacity. Katila and Ahuja (2002) suggested that absorptive capacity may be influenced by the content of external knowledge, such as knowledge similarity and heterogeneity. In addition, Lichtenthaler (2009) suggested environments are important factors that influence absorptive capacity, and he found that environments can moderate the relationship between absorptive capacity and innovation. In addition, Bilgili, Kedia and Bilgili (2016) argued that resource environments are crucial to absorptive capacity development.

2.3.2.4 Effects of absorptive capacity

(1) Absorptive capacity and innovation. Cockburn and Henderson (1998) used a case study to explore the relationship between absorptive capacity and product innovation, and they found that absorptive capacity can prompt product innovation. Kira (2009) examined the relationship between absorptive capacity and innovation performance. Results showed that R&D investment can improve enterprise innovation performance through absorptive capacity. Also, Lichtenthaker (2009) explored the relationship between absorptive capacity and innovation performance. Results showed that absorptive capacity positively affects innovation performance. Technology and market dynamism play moderating roles in the relationship between absorptive capacity and innovation. Different from previous research, Stock, Greis and Fischer (2001) suggested that there is an inverted U-shaped relationship between absorptive capacity and innovation. Zhou, Cao and Huang (2013) argued that absorptive capacity can enhance product innovation performance, and intellectual property risk plays a

moderating role in the relationship between absorptive capacity and product innovation performance. In addition, Zhou and Li (2016) discussed the relationship between absorptive capacity and product innovation performance. Results showed that absorptive capacity is positively related to product innovation performance, and intellectual property risk plays a moderating role in the relationship between absorptive capacity and innovation performance. Albort-Morant et al. (2018) investigated the relationships between the two dimensions of absorptive capacity (potential absorptive capacity and realized absorptive capacity) with green products and process innovation performance. Results showed that potential and realized absorptive capacities relate positively to both green process innovation performance and green product innovation performance.

(2) Absorptive capacity and performance. Jane, Salk and Lyles (2001) examined the relationship between learning and performance, and they found that absorptive capacity plays a mediating role in the relationship between learning and performance. Jian, Wu and Huang (2008) explored the influence of absorptive capacity on organization performance. Research showed that absorptive capacity can improve organizational innovation through knowledge integration. Also, Jian and Zhan (2009) examined the effect of absorptive capacity on technology transfer performance, and they found that absorptive capacity can enhance technology transfer performance. Cao, Zhu and Deng (2013) discussed the effect of absorptive capacity on university-enterprise cooperation performance. Results showed that potential absorptive capacity can influence university-enterprise cooperation performance through official cooperation; realized absorptive capacity can influence university-enterprise cooperation performance through information exchange. Also, Choi and Park (2017) examined the relationship between absorptive capacity and a firm's financial performance. Results showed that a firm's homogeneous absorptive capacity is positively related to short-term performance. However, a firm's heterogeneous absorptive capacity is likely to hinder its short-term business performance.

In addition, Jansen, Bosch and Volberda (2003) explored the relationship between absorptive capacity and firm performance. However, they found that there is an inverted U-shaped relationship between realized absorptive capacity and financial performance.

2.3.3 Knowledge integration: From the process perspective

2.3.3.1 Definition of knowledge integration

There are two different views on the definition of knowledge integration: Knowledge integration process and knowledge integration ability. In this study, knowledge integration is defined as the process to create new architectural knowledge—"a platform for carrying out new product and market combinations" (Boer, Bosch & Volberda, 1999: 381)—by using different types of component knowledge (Boer et al., 1999).

(1) Knowledge integration process.

Henderson and Clark (1990) introduced the concept of knowledge integration. They argued that product knowledge can be divided into component knowledge and architectural knowledge, and knowledge integration is defined as the process of creating new architectural knowledge. Based on previous research, Zhang, Liao and Zhang (2011) defined knowledge integration as contribution and combination.

According to Chen and Lu (2003), knowledge integration is to realize knowledge fusion. Chen, Zhan and Li (2009) suggested that knowledge integration includes three processes: Socialization, systematic and cooperation. Tzabbar, Aharonson and Amburgey (2013) argued that knowledge integration is to combine internal existing knowledge with external knowledge (such as knowledge from alliance partners). In addition, Wei and Xu (2014) defined knowledge integration as a process to deconstruct, combine, and reconstruct knowledge.

(2) Knowledge integration ability.

Kogut and Zander (1992) argued that knowledge integration is a kind of ability. Based on previous research, Lansiti and Clark (1994) argued that knowledge

integration ability can be divided into external knowledge integration ability and internal knowledge integration ability. More specifically, external knowledge integration ability mainly includes technology integration ability and customer integration ability. While internal knowledge integration ability includes cross-functional integration ability and problem-solving ability. Grant (1996) argued that knowledge integration is an ability to use the existing knowledge to create new knowledge and develop new technology. From the strategy perspective, Teece (1996) suggested that knowledge integration capability is the basic function and the nature of an enterprise competence. The purpose of knowledge integration is to create new architectural knowledge by combining various types of component knowledge existing in the organization (Boer et al., 1999). More particularly, knowledge integration can use three types of capabilities to combine component knowledge. System capabilities, which are associated with the directions, policies, and manuals, can create new architectural knowledge through rules and procedures (Khandwalla, 1977). Coordination capabilities relevant to the relations among team members can create new architectural knowledge through participation and training (Boer et al., 1999). Socialization capabilities, which refer to understanding rules for appropriate action, can create new architectural knowledge through cultural institutions, such as norms and values. Also, Xie, Wu and Wang (2008) argued that knowledge integration includes coordination capabilities and socialization capabilities. However, Chen and Yuan (2009) defined knowledge integration as an ability to deal with social interaction and organizational learning, and it includes external knowledge acquisition ability and internal knowledge integration ability.

2.3.3.2Measures of knowledge integration

. The main way to measure knowledge integration is using questionnaires. For example, Lin and Chen (2006) measured team knowledge integration using four-item scale. A sample item was “access to partners’ knowledge resources”. The Cronbach α for knowledge integration is 0.857. Based on Boer et al. (1999), Chen, Pan and Wu (2008) developed a knowledge integration process scale. In this scale, knowledge

integration includes three dimensions: System process, coordination process, and socialization process. The Cronbach α for the three dimensions of knowledge integration process were 0.83, 0.76, and 0.79, respectively.

2.3.3.3Influencing factors of knowledge integration

Base on previous studies, we summarized the factors that influence knowledge integration. It mainly includes knowledge, organizational factors, and environmental factors.

(1) Knowledge. Grant (1996) introduced the concept of knowledge integration, and he suggested two primary knowledge integration mechanisms—direction and routine. Direction refers to "the principal means by which knowledge can be communicated at low cost between specialists and the large number of other persons who either are nonspecialists or who are specialists in other fields" (Grant, 1996: 379). And an organizational routine provides "a mechanism for coordination which is not dependent on the need for communication of knowledge in explicit form" (Grant, 1996: 379). Boer et al. (l999) established the theoretical framework of knowledge integration, and he argued that knowledge integration process is consistent with knowledge integration needs, which is decided by the stage of industrial development and organizational structure. Kogut and Zander (1999) argued that knowledge integration can be influenced by five knowledge characteristics, which includes codifiability, teachability, complexity, responsiveness, and accessibility. According to Nonaka (1994), knowledge can be divided into explicit knowledge and tacit knowledge. When knowledge is explicit, knowledge integration can be realized through programmes. When knowledge is tacit, knowledge integration can be realized through communication. In addition, Xie et al. (2008) explored the influence of knowledge characteristics on knowledge integration, and they found that the degree of modularization, explicitness, complexity, and path dependence can influence knowledge integration.

(2) Organizational factors. Tiwanaand and Mdean (2005) explored the influencing factors of knowledge integration. Empirical research showed that social

capital and absorptive capacity can positively affect knowledge integration. However, experience heterogeneity has no significant effect on knowledge integration. Robert, Dennis and Ahuja (2008) explored the influence of communication environment and social capital on knowledge integration. Results showed that communication environment and structural capital have no significant effects on knowledge integration; relational capital and cognitive capital can significantly influence knowledge integration; communication environment plays a moderating role in the relationship between cognitive capital and knowledge integration. Zhang (2010) explored the trigger factors of team knowledge integration. Results showed that individual social network has a direct effect on knowledge integration. Moreover, knowledge orientation and cooperation satisfaction have indirect effects on knowledge integration. Jin and Li (2012) explored the relationship between team members' background characteristics and innovation performance. Results showed that knowledge sharing can positively influence knowledge integration, which in turn will influence innovation performance. Also, Zhong, Wu and Luo (2016) confirmed that internal knowledge sharing is an important factor that affects knowledge integration.

Bhandar, Pan and Tan (2007) conducted a case study to examine how organizations prompt knowledge integration. Results showed that social capital plays different roles in knowledge integration at different stages. For example, at the initial stage of a project, social capital can prompt knowledge integration, and at the stage of project implementation, social capital may inhibit knowledge integration. According to Chen et al. (2008), social capital can be divided into internal social capital and external social capital, and internal social capital can prompt knowledge integration. However, Xie et al. (2008) suggested that in addition to the social capital, organizational culture can also influence knowledge integration. Xie et al. (2007) took 144 companies in south China as an example and explored the relationship between organizational learning and knowledge integration, and they found that organization learning has a positive relationship with knowledge integration.

In addition, environments are crucial to knowledge integration. For example, Sun et al. (2012) explored the influence of environmental uncertainty on innovation performance, and they found that environmental uncertainty is positively related to knowledge integration.

2.3.3.4Effects of knowledge integration

Knowledge integration and innovation. Hui and Zou (2010) explored the relationship between the industry-university-institute network and technology innovation, and they found that knowledge integration can influence technology innovation.

Jiang, Zhang and Wang (2009) took 163 enterprises in Zhejiang, Jiangsu, and Shanghai as the research object, and explored the relationship among strategic leadership behavior, learning orientation, knowledge integration, and organizational innovation performance. Results showed that knowledge integration is positively related to innovation performance. Li et al. (2012) also confirmed that learning and knowledge integration are positively related to innovation performance. In general, previous research on the relationship between knowledge integration and innovation mainly focuses on the organizational level. At the team level, Wang and Li (2016) argued that team knowledge integration plays an important role in promoting creativity.

Knowledge integration and performance. Jian et al. (2008) found that knowledge integration plays an important role in improving organizational performance. According to Xie et al. (2008), knowledge integration can influence organizational performance through core competence. In addition, Korner et al. (2016) examined the relationship between knowledge integration and performance in health care. Results showed that knowledge integration is significantly associated with patient-centered teamwork as well as to team performance.

2.4 Summary

Through literature review, we have a better understanding of the progress of knowledge acquisition (including external knowledge search and internal knowledge sharing) and creativity. More specially:

First, knowledge acquisition is an important influencing factor of creativity. Recently, many scholars have explored the relationship between knowledge acquisition and creativity. For example, Huang et al. (2014) explored the relationship between knowledge sharing and creativity. Results showed that team-level knowledge sharing activities and individual team members' expertise dissimilarity jointly predict individual creativity. However, it focused on individual level expertise dissimilarity and used functional department—a weak proxy to represent team members' diversity (Huang et al., 2014); Soo et al. (2007) examined the relationship between external knowledge search and creativity, and they found that knowledge search can influence learning and creativity. However, despite this type of knowledge management's theoretical significance and substantial enhancement of creativity, to date, few studies have investigated the underlying mechanism, leaving unclear how knowledge acquisition such as external knowledge search and internal knowledge sharing shapes team creativity.

Second, the influencing factors of knowledge acquisition at different levels. At present, many scholars have explored the influencing factors of external knowledge search and internal knowledge sharing. For example, Kurt et al. (2008) argued employees' personality traits can positively influence knowledge sharing. In addition, organizational atmosphere, leadership, and culture can influence knowledge sharing willingness and behavior (Zarraga & Bonaehe, 2003). For example, Matic et al., (2017) showed that organizational climate can influence knowledge sharing behavior. Li et al. (2014) argued that transformational leadership is positively related to employee knowledge sharing behavior. Liu, Du and Ai (2016) suggested that collectivism will promote knowledge sharing, and power distance will inhibit knowledge sharing.

Third, previous research shows that redundant resource and organizational strategy are important factors that affect knowledge search. For example, Li, Fan, and Zheng (2015) found that redundant resource has an important effect on external knowledge search. More specifically, redundant resource will prompt external knowledge search width. In addition, they found that cost leading strategy can inhibit external knowledge search, and differentiation strategy can prompt external knowledge search. In sum, prior work on the influencing factors of knowledge acquisition at different levels helps us comprehensively understand the process of knowledge acquisition.

In addition, transformation from single knowledge acquisition to dual knowledge acquisition. Previous research on knowledge acquisition has focused either on internal knowledge sharing or on external knowledge search, and examined the relationship between knowledge acquisition (i.e. external knowledge search and internal knowledge sharing) and innovation. For example, Liao et al. (2007) explored the relationship between employee knowledge sharing and enterprise innovation in learning organization. Results showed that knowledge sharing can promote enterprise innovation. Moreover, he found that knowledge sharing with suppliers can influence business innovation in industrial clusters. In addition, Segarra-Cipres and Bou-Llusar (2018) suggested that external knowledge search plays an important role in promoting innovation performance. Cruz-González et al. (2015) argued that the influence of external knowledge search on firm performance depends on environmental dynamism. Recently, scholars have realized that it is not enough to solely rely on one single knowledge acquisition approach to acquire knowledge. For example, Cassiman and Veugelers (2006) have suggested that even the largest active-active organization cannot rely solely on internal resources for innovation. It needs to acquire knowledge from other organizations beyond their boundaries. Marco-Lajara et al. (2016) argued that it is difficult for firms to acquire all the required knowledge from inside. And they suggested that it is crucial for organizations to acquire knowledge from both inside and outside to keep organizations' survival and competitiveness.

Chapter 3: Trigger factors and effects of knowledge acquisition

3.1 Objective and research method

In this Chapter, we will explore the trigger factors and effects of knowledge acquisition (including external knowledge search and internal knowledge sharing) through grounded theory.

Grounded theory is a qualitative method and primarily used by sociologist for theory generation (Glaser & Strauss, 1967). Glaser (1978) argued that grounded theory focuses on social processes instead of social structure. Denscombe (2003) suggested that grounded theory was based on raw materials, and the purpose of grounded theory is to form a new concept or theory instead of simply describing an existing phenomenon. In addition to theory generation, grounded theory is used to build up conceptual descriptions according to the grounded theory analysis approach (Polit & Beck, 2006). According to grounded theory, the process to analyze data is known as encoding (Strauss and Corbin, 1990), and it includes open coding, axial coding, and selective coding. In this study, we strictly abide the procedures of coding to ensure the reliability and validity of the model.

3.2 Interviews

(1) Interviewees. According to the rules of typicality and consistency (Corbin & Strauss, 1990), interviewees are mainly from project teams, R&D teams, and research teams. For example, M2, M3, M5, M6, M7, and M13 are from project teams; M1, M4, M8, M14, M9, M16, M10, and M12 are from R&D teams; M11 and M15 come from research teams. There are three reasons why we select these interviewees. First, these interviewees are knowledge workers. That is, most of them have a bachelor's degree or above, and they can think actively and express themselves clearly. Second, these

interviewees engage in innovative behaviors. Third, we can guarantee the reliability of the case, because the purpose of the study is introduced before the interview, and we assured them that we will not disclose relevant information such as product name. Based on theoretical saturation criteria, 16 interviewees were finally selected. Table 3.1 present the basic information of interviewees

Table 3.1 Basic information of interviewees

Number	Interviewee	Age	Education	Occupation	Identity	Team type	Affiliation
M1	Mr. Zheng	22	Bachelor	Software	employee	R&D	Guotaian
M2	Mr. Lu	30	Master	Engineer	supervisor	Project	Yuxiao
M3	Ms. Li	26	Master	Planner	employee	Project	South Wangtong
M4	Mr. Hao	30	Master	Software	employee	R&D	Dongfang Electronics
M5	Mr. Jiang	28	Master	Designer	employee	R&D	Zhengyuan
M6	Mr. Zhang	36	Bachelor	Designer	supervisor	R&D	Yantai Binglun
M7	Mr. Yang	28	Bachelor	Planner	employee	Project	Guotaian
M8	Mr. Wang	31	Bachelor	Software	supervisor	R&D	Dongfang Electronics
M9	Mr. Yang	35	Master	Software	employee	R&D	Hisense
M10	Mr. Liu	32	Master	Software	employee	R&D	Xinyue Network
M11	Mr. Li	30	Doctor	Student	student	Research	Tongji University
M12	Mr. Wang	32	Bachelor	Software	employee	R&D	Yihangxian Network
M13	Mr. Wang	28	Master	Planner	employee	Project	South Wangtong
M14	Mr. Zou	30	Bachelor	Software	employee	R&D	Dongfang Electronics
M15	Mr. Ding	30	Doctor	Student	student	Research	Tongji University
M16	Mr. Liu	29	Master	Software	employee	R&D	Hisense

(2) Interview process. According to the interview outlines, we combine the specific circumstances with instant questions to obtain the required information. For example, we ask questions such as “Please give us some examples.” and “If the situations are opposite, what will you do?”. With the consent of the interviewees, the interview process was recorded. Every interview lasts about 60 minutes and the interviewees’ e-mails are accessed for the follow-up study. In order to preserve the true interview information, we conducted an analysis according to interviewees’ original words. We randomly selected 3/4 of the interview records (12 copies) for

coding analysis and model construction, and another 1/4 of the interview records (4 copies) are reserved for theoretical saturation test.

3.3 Coding and categorizing

3.3.1 Open coding

Open coding is the process of disrupting the original materials and giving a concept (Glaser, 1978). In open coding process, we strictly abide the rules—fit and relevant (Charmaz, 2017). That is, we try to use the original conversation words, which reflect interviewees' viewpoints and their perception and true feelings of the situation. In this study, we code "line by line" and "sentence by sentence". More specifically, we read through the transcript line by line to select phases or words that represent the whole meaning.

After open coding, we get more than 340 original statements and initial concepts. We categorize the initial concepts because some initial concepts are overlapping. More specifically, we remove the initial concepts whose repetitive frequency is less than 2 times. Also, we removed the initial concepts which are contradictory. Table 3.2 shows the initial concepts and categories (see Appendix B).

Table 3.2 Open coding

Category	Original statements
External communication	a1；a8；b41；b42；c22
Market research	a6；c23；f2；k5
Data collection	a21；b40；c19；e1；e4；e9；e10；k2；i18；
Internal communication	a2；a19；c1；c3；d1；d6；d7；e2；e16；f1；h19; k1；k28
Internal discussion	a7；b8；b37；b38；k11
Work requirement	a3；a14；a15；b9；b12；c9；d3；e18；f7；g6；i2；k3；k4; b5；b6；c14；b21；e3；f13；g30；h1；i10；j20；k3；k4；i19
Incentive	i8；j10；i11
Achievement	h3；h4；k18；k19
Interest	c27；g2；h5；i1; d4；e7；g31；h2；i11；j19；k8
Willingness	a16；a20；f5；k20；h12；j9；k15；k20
Self-interest	b21；j3；k21
Conscientiousness	c8；f3；h7；h10
Extraversion	i3；l3

Initiative	c20；f5；g28；h12；j1；j17；k13；k15
Cognitive trust	e18；f4； h11；h13；j2；i29
Affective trust	b11；b13；j2
Task conflict	b7；b16；i6；l8
Emotional conflict	b24；j4
Proactive personality	a16；b14；c20；f5；h12；j1;k13；k15；g28；i12；j17
Diversity strategy	b46；f19
Cost leading strategy	b44；f12
Fairness	b20；b23；b25；j9
Perceived support	a17；b30；c26；f25；i7；j8；
Learning culture	c11；f14；j18；i1；i17
Cooperative culture	b26；e17；e19；g15；k16；
Assimilating capacity	a27；b2；i18；l12；l25；l33
Transformative capacity	a28；e21；i17
Exploitive capacity	d9；e20；f8；g13；i16；k35；k36；l34
Systematize	d10；e11；g7；g17；i19；i20；k28；
Socialize	e23；g17
Cooperate	e25；g23；g32；f8；h9；l27
Novel ideas	a9；a13；a10；a26；b35；c17；e26；g19；g25；g29；h21；j14；j26；k17；l20；l24
Useful ideas	a12; e29
Explorative innovation	b36；b37；f12；h22；l13；l14；l15；
Exploitative innovation	d11；e12；k26；l31

3.3.2 Axial coding

Axial coding is to search for relationships and consequences among the categories (Strauss and Corbin, 1990). The aim of open coding is to develop vice category, while the aim of axial coding is to develop the main category. More specifically, first, we find different vice categories, which are obtained in the open coding process. Second, according to the relationship between different categories and the logical order, we re-classify vice categories. Finally, we get 6 categories and 13 main categories (See Table 3.3).

Table 3.3 Axial coding

Category	Main Category	Vice Category	Definition
Knowledge acquisition	External knowledge search	External communication	Go to enterprises or universities to collect information
		Market research	To collect and analyze information which is from supplier and consumer

		Data collecting	Collecting documentation or work-related data
	Internal knowledge sharing	Internal communication	Communication in daily work
		Internal discussion	Discussion on a project or a question
Work value-orientated (Dynamic element)	Career-orientation (cognitive triggers)	Work requirements	A knowledge acquisition activity that is needed to accomplish a job or project
		Incentive	Material rewards
		self-interest	Actions and reactions based on personal interest
	Calling-orientation (cognitive triggers)	Interest	A mental activity that derives from enjoyment
		Willingness	A mental activity or behavior that arises from the need
		Achievement	A psychological satisfaction on self-worth realized by knowledge behaviors
Individual knowledge acquirement characteristics (Basic element)	Personality (Intrinsic triggers)	Conscientiousness	A personality which is associated with adjectives such as efficient, reliable, organized, planful, responsible, thorough, and risk averse
		Extraversion	Ambition and sociability
		Openness to experience	Actively sharing or searching relevant knowledge
Context-perception (situational element)	Relationship perception (Cognitive triggers)	Cognitive trust	A kind of trust based on the credibility and reliability between employees
		Affective trust	A kind of trust based on emotional feeling
		Task conflict	Differences in opinion and expectations in terms of tasks, goals, and processes.
		Emotional conflict	A kind of conflict or hostility based on emotional feeling
	Organizational strategy	Diversity strategy	A strategy to adopt different products, services, and corporate image
		Cost leading strategy	A strategy to decrease cost
	Team climate (Cognitive triggers)	Fairness	A fair feeling about organizational systems and policies
		Perceived support	A general perception and belief in how organizations view employees' contributions
	Organizational/ team culture (Cognitive triggers)	Learning culture	A culture encouraging employee to learn new knowledge
		Cooperative culture	A culture emphasizing on cooperation
Mechanism	Absorptive capacity	Assimilating capacity	An ability to recognize and digest knowledge
		Transformative Capacity	An ability to transfer knowledge in different ways
		Exploitive capacity	An ability to extend and utilize existing knowledge
	Knowledge integration	Systematize	Prompt knowledge combination through standardization
		Socialize	Prompt knowledge combination through value and institution
		Cooperate	Employees' cooperation and support

Innovation	Idea generation	Novel ideas	Refreshing ideas or thought
		Useful ideas	Ideas can be used.
	Idea implementation	Explorative innovation	Radical and risky innovation
		Exploitative innovation	Incremental innovation based on previous existing knowledge

More specifically, knowledge acquisition mainly includes external knowledge search and internal knowledge sharing. Knowledge search includes communication (i.e. a8: go out to learn new skills; b41: search work-related knowledge from other companies), market research (i.e. f2: from outside), and data collecting (i.e. a21: search AVC encoding standard; l18: collect industry-relevant materials). Internal knowledge sharing includes communication (i.e. a2: from my colleagues; c1: internal communication) and discussion (i.e. a7: further discussion; b38: a long-time discussion)

Value orientation includes career-orientation and calling-orientation. Career-orientation includes work needs (i.e. a3: project needed), incentives (i.e. j10: reward and punishment), and self-interest (i.e. b21: selfish); Calling-orientation includes enjoyment (d4: interested in), willingness (i.e. a20: would like to) and sense of achievement (i.e. h4: identified by colleagues); Personality traits including responsibility (i.e. c8: be responsible for), extraversion (i.e. l3: extrovert) and proactive personality (i.e. c20: initiative); Relationship perception including cognitive trust (i.e. j2: a trust relationship), affective trust (i.e. b11: have a good relationship), cognitive conflict (i.e. b16:disagree with each other) and emotional conflict (i.e. b24: be envied); Organizational strategy includes diverse strategy (i.e. b46: transforming to other business), cost leading strategy (i.e. b44: keep original development and reduce the cost); Team climate includes support (i.e. a17: supported by our leader) and sense of fairness (i.e. b20: feel unfair); Team culture includes learning culture (i.e. c11: emphasizes learning) and collaborative culture (i.e. e17: cooperation).

Influence mechanism mainly includes absorptive capacity and knowledge integration. Absorptive capacity includes assimilating capacity (i.e. e21: digest the knowledge), transformative ability (i.e. i17: transform knowledge) and exploitive

capacity (i.e. d9: utilize acquired knowledge), knowledge integration includes systematic integration (i.e. d10: integrate others' source code), social integration (i.e. e23: integrates enterprise elements) and cooperative integration (i.e. g32, integrate diverse resources).

In addition, innovation mainly encompasses creativity and idea implementation (Anderson, Potočnik & Zhou, 2014). Creativity include novelty (i.e. e26: novel) and usefulness (i.e. a12: technical feasibility); Idea implementation reflects explorative innovation (i.e. f12: develop a new product) and exploitative innovation (i.e. e12: exploit other team members' knowledge).

3.3.3 Selective coding

Selective coding is to select the core category, and establish relations with other categories (Glaser, 1978). Selective Coding is dealing with the relationship among categories. It is to explore the core category, and analyze the relationship between core category and other categories. It will be presented in the form of story line to describe the phenomenon. The story includes categories as well as contexts, and it helps to develop a new framework. The mainline of the story line (i.e. typical relational structure) and the representative statements of respondents are shown in Table 3.4.

Table 3.4 Selective coding

Relationships	Connotation of the relationship structure	Representative statements
Work Value-orientation (Call-orientation) ↓ External knowledge search	Calling-orientation is one of the trigger factor of external knowledge search	M3：Sometimes I may search the internet for work-related knowledge. For example, one time my supervisor asked us whether we can use the software—Axture. However, no one knew how to use it. At that time, I was curious about this software and wanted to know how to use it. Consequently, I searched the relevant knowledge about how to use Axture.

		M5: In addition to in-role work requirements, interest is also crucial to external knowledge search. M11: In addition, personal interest also prompts knowledge search. For example, if I am interested in "fuzzy evaluation, I may actively search fuzzy-relevant knowledge.
Work value-orientation (Career-orientation) ↓ External knowledge search	Career-orientation is one of the trigger factors of external knowledge search	M2: There are two reasons to search external knowledge. One is organizational requirements. The main aim of our company to engage in project is for profit. Accordingly, we need to search work-related knowledge and solve project problems. The other is personal requirements. Project engagement can improve employees' skills and expertise. M3: In order to improve my professional skills and core competitiveness, I may search work-related knowledge in my spare time. It is helpful to increase my salary. M8: At the beginning, I need to learn a lot. I visited BBS and bought may books to improve myself. Later, I began to pay attention to the latest development of Android system. It is work requirement.
Team support ↓ External knowledge search	Leaders' support is one of the trigger factors of external knowledge search	M11: In fact, our supervisor's support also prompts us to search relevant knowledge. For example, in order to support our scientific research, our supervisor bought many books about arithmetic for us. If we meet problems, we will search relevant

		knowledge to solve it. M6: Every year, I prepare a fund of money to encourage employees to learn specialized expertise and skills from universities or other companies, because it is a good opportunity to increase employees' knowledge.
Organizational strategy ↓ External knowledge search	Diverse strategy and cost leading strategy are the trigger factors of external knowledge search	M2: Now the whole geological prospecting industry is in depression. About 90% of the coal industry is operating at a loss. Moreover, the prospect of coal industry is not good, because coal is non-renewable resources and because it can cause serious pollution problems. Now, our leader is considering company transformation. One way is to keep the original development. However, we should reduce the cost. Another way is transforming to other business. Anyway, I will either learn new work-related knowledge or quit my job. M6: The other change is business model. We used to be OEM, and now we develop our own products. In the process of business model transformation, we need to recruit some new employees and fire some employees. More specifically, if you would not like to learn new skills and technologies, you may be fired. M6: Business model transformation can influence knowledge search. For example, you want to give up an existing product and develop a new product. This is a complicate process. More specifically, you

		need to analyze the technical feasibility and provides various materials.
Organizational/ team culture ↓ External knowledge search	Learning culture in organizational culture is the trigger of external knowledge search	M3: In our team, we have a learning culture. More specifically, our supervisor often encourages us to learn work-related knowledge to enrich our professional skills. Also, our supervisor encourages us to share our knowledge with colleagues. M6: In addition to work requirement, culture is another motivation to search knowledge. For example, we have a learning-oriented culture. More specifically, we train our employees to acquire diverse knowledge and improve their skills. This is our advantage. However, in small companies, leaders would not like to establish corporate culture and vision. Also, they would not like to invest a lot to train their employees. M10: Team culture is a core value. If employees do not have a shared belief and goal, they are more likely to pay attention their own task performance instead of the whole team task performance. In all, team culture is very important. A learning culture can prompt team members to search external knowledge actively.
		M1: When my colleagues requested work-related knowledge, I will share my knowledge with them, because knowledge sharing can help them to accomplish their work successfully, which in turn will be beneficial for the whole project. Sometimes, I would like to actively share my knowledge with

		colleagues. M6: As a team supervisor, I have the duty to share my knowledge with employees.
Personality ↓ Internal knowledge sharing (External knowledge search)	The conscientiousness and extroversion of personality traits are the trigger factors of internal knowledge sharing	M8: Even if I become a team supervisor, I still would like to share my knowledge. On the one hand, it is my responsibility; On the other hand, I feel happy to help my subordinates to improve them. I am familiar with many fields, such as Android and Rupy. Most of the time, I can help my subordinates to solve all the problems. M9: Most of the time, I would not like to share my knowledge with colleagues because I am introverted. M12: New employees would not like to share their knowledge because they are afraid of ridiculing by colleagues. Also, some new employees would like to share their knowledge, especially when they are extrovert. M7: How to produce novel ideas? Where does this work-related knowledge come from? One is interest. More specifically, I would like to actively search work-related knowledge which I am interesting in. The other is work requirement. That is, I have to search work-related knowledge to solve problems. M9: Sometimes, I actively search knowledge about HTML, CSS, and JS. Work requirement and personal interest are two main factors to prompt external knowledge search. Of course, we also

		should be conscientious to search work-related knowledge.
Work value-orientation (Calling-orientation) ↓ Internal knowledge sharing	Enjoyment, willingness, and achievement are trigger factors of internal knowledge sharing	M1: I would like to share my knowledge with colleagues because knowledge sharing can prompt communication and maintain good relationship. Sometimes, I will proactively search knowledge. For example, we needed AVC video coding (H. 264). However, there was no related knowledge in our knowledge base. Thus, we had to search AVC coding standard documentation from other sources. M3: Sometimes, I would like to share some work-related knowledge which was acquired on the internet. M8: I would like to share information and knowledge with colleagues. For example, I will share some simple programs with my colleagues. When the simple programs are identified by my colleagues and praised by my supervisor, I will be more likely to share my knowledge.
Work value-orientation (Career-orientation) ↓ Internal knowledge sharing	Incentive, work requirements, self-interest are trigger factors of internal knowledge sharing	M9: In fact, leaders are very important because they can create a mastery climate to encourage knowledge sharing. If employees who share knowledge are rewarded and employees who hide knowledge are punished, they are more likely to share knowledge instead of hiding knowledge. M10: Second, team leaders should establish reward and punishment rules. For example, employees who share more should be rewarded more. M1: For example, one previous project needed a

		specialized software (streaming media). However, we did not have this software. We designed a new one to replace this software because we can reduce our cost and because we can have our own intellectual property. More specifically, first, we searched relevant solutions which were provided by Intel. Second, we conducted a parameter analysis and reported the results. Finally, the whole project team members had a further discussion and shared relevant knowledge to other departments. M2: For example, one of my colleagues makes less contribution to the overall performance of our work unit than me. However, he has a similar wage and treatment with me. In addition, our supervisor often praises him. Thus, I may feel unfair and keep selfish. More specifically, I may try my best to improve myself and not share critical knowledge with colleagues.
Relationship perception (Trust) ↓ Internal knowledge sharing	Cognitive trust and affective trust are trigger factors of internal knowledge sharing	M8: I trust my team members. Interpersonal trust can prompt me to share my knowledge actively, which in turn will improve team members' ability to solve problems. M6: I trust our company, and I am very optimistic about the future development prospect of our company. This trust prompts me to share the most recent information at the meeting. M2: If I have a good relationship with one of my colleagues, I will share my knowledge. In other words, if I do not compete with her or him, I will

		share my knowledge. M10: However, if it is inconvenient for me to tell my colleagues about some work-relevant knowledge, I will tell them the reason honestly. It needs time to establish a trust relationship, especially when we don't know each other.
Relationship perception (Conflict) ↓ Internal knowledge sharing	Task conflict and Affective conflict can hinder internal knowledge sharing	M2: Most of the time, I may share my knowledge with colleagues. Sometimes, I would not like to share my knowledge with colleagues because I compete with them. M2: There are many sophisticates in our team. If they frown upon your behavior, they will not listen to you and make trouble. Of course, unfairness may lead to jealousy. Sometimes, employees who are excellent may be more likely to be envied under unfair conditions. M9: If you were me, we might do the same. You may not share some crucial knowledge. In fact, this is related to organizational and team climate. For example, if you are working in a performance climate, which emphasizes competition and goal achievement, you would not like to share your knowledge with colleagues. M10: If I do not like one of my colleagues, I will not share my vital knowledge with him.
		M1: Also, knowledge sharing is supported by our leader. Most of the time, work requirements prompt knowledge sharing. M2: Each company has a knowledge base. Some

Team climate ↓ Internal knowledge sharing	Team climate is one of the trigger factors of internal knowledge sharing	knowledge is presented in words. Some knowledge is in the mind of employees and can be influenced by personal values, beliefs and experience, Leaders encourage employees to transform the knowledge in their minds into words and keep updating companies' knowledge base. However, employees would not like to share their vital knowledge. M2: We have some problems in management, such as treating employees unfairly. If you are treated unfairly, you may not share your knowledge with colleagues. M10: In my opinion, team leaders should encourage team members to share their knowledge. Also, team leaders should share their experience actively and treat team members fairly.
Organizational/team culture ↓ Internal knowledge sharing	Organizational/ team culture is one of the trigger factors of internal knowledge sharing	M9: Work requirements prompt us to share our knowledge with colleagues. I hope that our company can establish a learning platform to help us to share knowledge. Also, our team can organize some activities to share knowledge. M12: We have a learning culture. For example, we have sharing session and learning session which are based on knowledge exchange. M5: We communicate with each other frequently. For example, we often share the latest technology and work-related information with one another. I think this is related to the cooperation atmosphere in our team. M11: Sometimes, I may share my professional

		knowledge actively. For example, I am interested in fuzzy search and evaluation, and I will share relevant knowledge in our team. Also, I may ask our colleagues to provide some suggestions to produce new ideas. In addition, team cooperation can prompt us to share our knowledge.
External knowledge search ↓ Creativity	External knowledge search can influence creativity	M1: When I go out to learn new skills or communicate about work-related matters, I will pay attention to some new techniques, which is helpful for the production of novel and useful ideas. M3: It is not easy for me to write a good copywriter because my supervisor often requires the copywriter to be novel and there are no ready-made templates. In addition, I need to actively search plenty of raw materials. This is task requirement. M7: How to produce novel ideas? Where does this work-related knowledge come from? One is interest. More specifically, I would like to actively search work-related knowledge which I am interesting in. The other is work requirement. That is, I have to search work-related knowledge to solve problems.
Internal internal knowledge sharing ↓ Creativity	Internal knowledge sharing can influence creativity	M1: Of course, when I come back, I will share these new techniques with my colleagues. Sometimes, we may analyze the technical feasibility and market possibility to generate some new ideas. M8: In our team, we have sub-groups, such as Android group, Windows group, and IOS group.

		Sometimes we focus on specific topics, such as industry 4.0 and LOT. Everyone is asked to share their knowledge, expertise, and problems. This can help us to produce new ideas. For example, an employee is good at c++, and the other is good at designing. Knowledge exchange may be helpful to produce new ideas. M12: Also, we can produce new ideas through brainstorming. We should master multiple areas of knowledge, such as special knowledge about interaction design and visual design. In addition, we should have composite skills which can help us to integrate all kinds of knowledge and produce new ideas.
External knowledge search ↓ Absorptive capacity ↓ Creativity	External knowledge search can influence creativity through absorptive capacity	M1: In fact, only searching external knowledge is not very helpful for us. The key is to absorb this knowledge and transfer it into our own. M2: I work on geology. I am good at structural analysis and water-filling analysis in hydrogeology. Sometimes I look up related books and papers to acquire work-related knowledge. This can help me to absorb others' knowledge quickly. Also, this can help us to integrate our specific situation with acquired knowledge to generate proper solutions. M11: It is very tired for us to do experiments and write high-quality papers. Our study also needs innovation. Innovation is based on the results of previous studies. It requires us to search, accumulate, absorb, and exploit work-related

		knowledge, which is helpful to build well-grounded power.
Internal knowledge sharing ↓ Absorptive capacity ↓ Creativity	Internal knowledge sharing can influence creativity through absorptive capacity	M5: In fact, knowledge sharing is the first stage of problem-solving process, and how to use knowledge is the second stage of problem-solving process. Employees should understand and digest the knowledge shared by their colleagues. M6: Knowledge sharing can help us to understand what the employees in other departments are doing. Diverse knowledge should be utilized and integrated to produce new product. Also, we should consider the future prospect of the product. M12: Knowledge sharing can improve employees' absorptive capacity. The absorbed knowledge, experience, and skills can be applied to the actual project, which in turn will prompt content innovation, method innovation, and process innovation.
External knowledge search ↓ Knowledge integration ↓ Creativity	External knowledge search can influence creativity through knowledge integration	M4: Not all searched knowledge is helpful for us. More importantly, we should absorb knowledge and learn how to utilize acquired knowledge. Sometimes, we need to exploit and integrate others' source code to develop new software. M11: This is a big project. If we don't use open source software, we will take too much time to write new code. Thus, we can make a revision according to the open source software, such as adding new ideas to the open source software. In fact, this is an exploitative innovation process

		because it integrates existing algorithm and our own ideas. M7: Searching information and knowledge from my colleagues can help me to integrate diverse resources and to come up with novel ideas.
Internal knowledge sharing ↓ Knowledge integration ↓ Creativity	Internal knowledge sharing can influence creativity through knowledge integration	M6: We have a meeting every month. At the meeting, each department supervisors (e.g., sales department, planning & design department, and R&D department) will introduce the progress of their work. This is work requirement. M12: Also, we can produce new ideas through brainstorming. We should master multiple areas of knowledge, such as special knowledge about interaction design and visual design. In addition, we should have composite skills which can help us to integrate all kinds of knowledge and produce new ideas. M12: In our work, we should learn to cooperate with each other, share our knowledge, and absorb colleagues' knowledge. M10: Team leaders should create a shared belief. In general, a leader plays an important role in knowledge sharing, and they should encourage team members to share knowledge. Of course, employees can produce new ideas through knowledge sharing.

Based on the core category of trigger factors and effects of knowledge acquisition, the story line is as follows:

The trigger factors of knowledge acquisition mainly include calling-orientation,

career-orientation, personality, relationship perception, team climate, organization/team culture, and organizational strategy.

More specifically, as shown in Figure 3.1 and Table 3.3, the trigger factors of external knowledge search include cognitive triggers and intrinsic triggers. Intrinsic triggers include calling-orientation (i.e. e7: interest) and personality traits (i.e. g28: initiative); Identified triggers includes career-orientation (i.e. b5: organizational requirements), team climate (i.e. k9: supervisor's support), organization/team culture (i.e. f14: a learning-oriented culture), and organizational strategy (i.e. b46: diversity development; b44: keep original development and reduce the cost). Calling-orientation and career- orientation, which belongs to work value orientation, are dynamic elements; Personality is a basic element; Team climate, organizational strategy, and organization/team culture are situational elements.

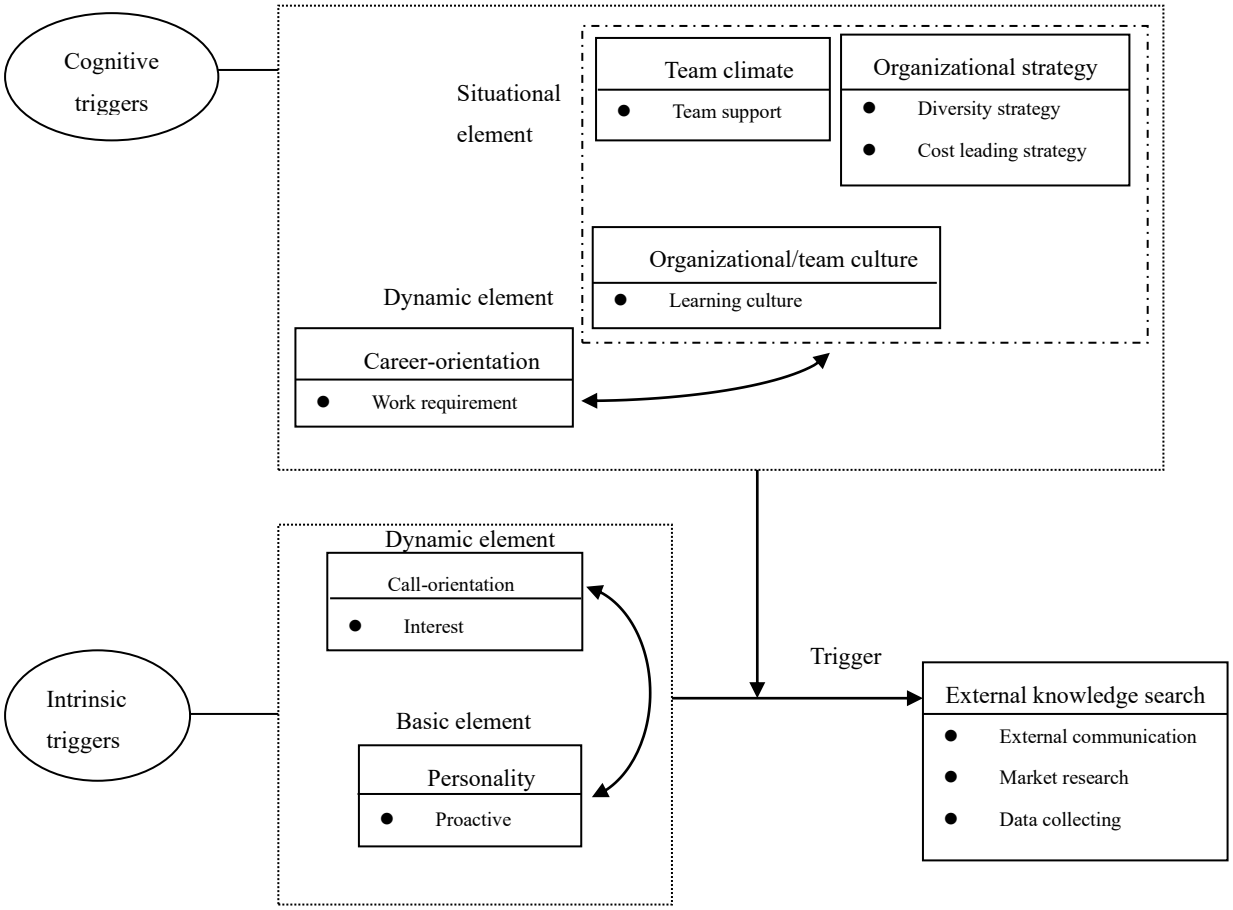


Figure 3.1 Trigger factors of external knowledge search

As shown in Figure 3.2 and Table 3.3, the trigger factors of internal knowledge sharing include cognitive triggers and intrinsic triggers. Calling-orientation and personality traits are intrinsic triggers. More specifically, calling-orientation includes enjoyment (i.e. d4: interested in), willingness (i.e. a20: would like to), and sense of achievement (i.e. h4: identified by colleagues); and career-orientation, team climate, relationship perception, and organization/team culture belong to cognitive triggers. In particular, career-orientation includes work requirements (i.e. a3: project needed), incentives (i.e. j10: reward and punishment), and self-interest (i.e. b21: selfish). Team climate includes perceived team support (i.e. a17: supported by our leader) and team fairness (i.e. b20: feel unfair); Team culture includes learning culture (i.e. c11: emphasizes learning) and collaborative culture (i.e. e17: cooperation). Relationship perception includes cognitive trust (i.e. j2: a trust relationship), affective trust (b11, i.e. have a good relationship), cognitive conflict (i.e. b16: disagree with each other), and emotional conflict (i.e. b24: be envied). Cognitive conflict and affective conflict can inhibit internal knowledge sharing. Calling-orientation and career-orientation, which belongs to work value orientation, are dynamic elements; Personality is a basic element; Team climate, organizational strategy and organizational (team) culture are situational elements.

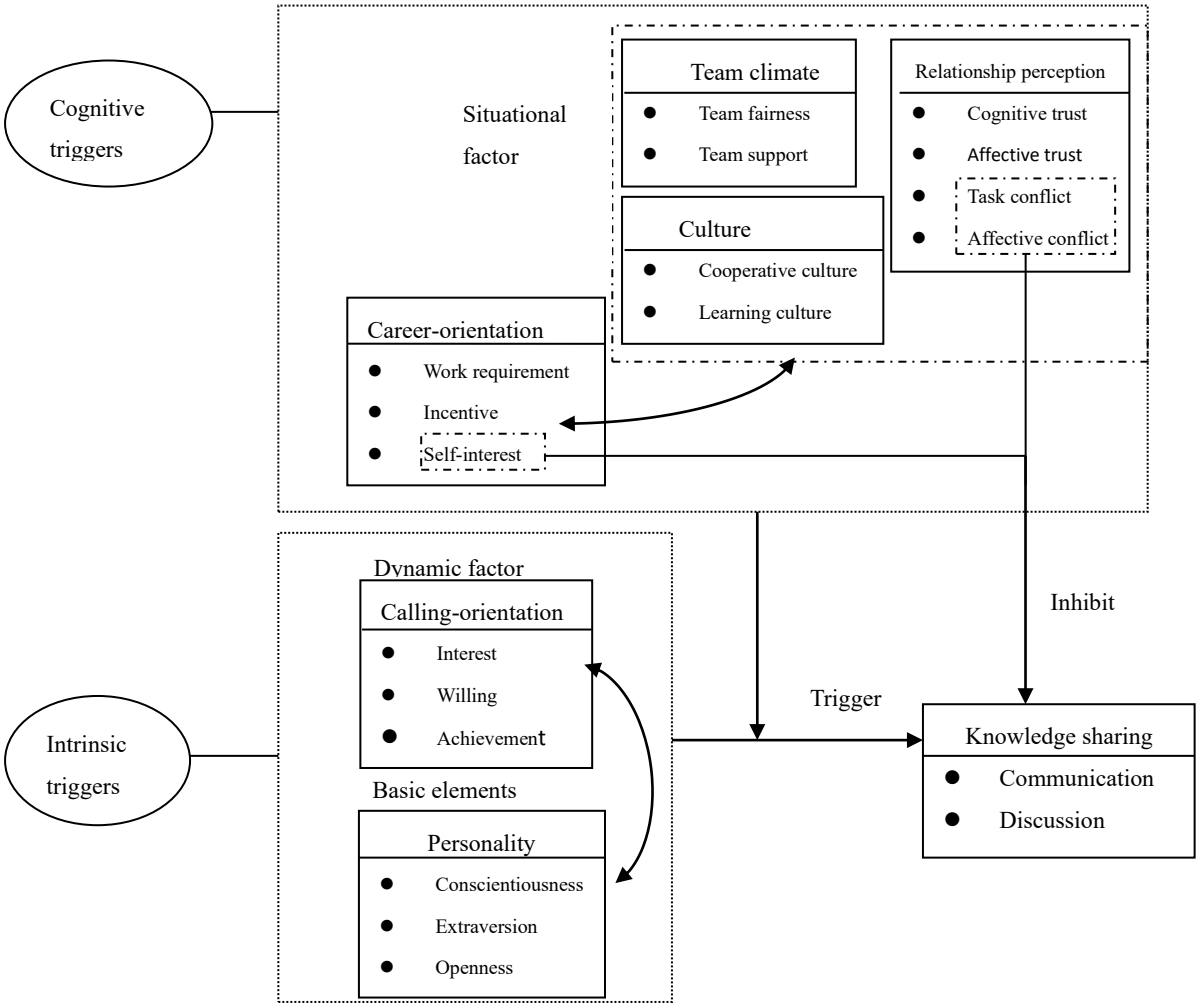


Figure 3.2 Trigger factors of knowledge sharing

In fact, knowledge acquisition is the interactions of career-orientation, personality and situational perception. Work value orientation, which is the dynamic element, can answer the question "why". Personality, which is the basic element, can answer the question "whether". Situational elements can answer the question "when".

According to Gelade, Dobson and Auer (2008), work is an important part of an individual's life, and an individual's goal of work is to realize his achievement. Calling-orientation is a dynamic element and it depends on some basic elements such as personality. Previous research has shown that conscientiousness, extraversion, and proactive personality are important intrinsic trigger factors of knowledge acquisition. Individuals with high conscientiousness and extraversion are more likely to search

and share knowledge (Anwar, 2017); In addition, we found that career-orientation and situational perception are important cognitive triggers, and they can be stimulated by external value.

In addition, knowledge acquisition (including external knowledge search and internal knowledge sharing) plays an important role in improving creativity and innovation. At the same time, absorptive capacity and knowledge integration play mediating roles. Based on this story line, we constructed a framework that includes the trigger factors and effects of knowledge acquisition (see Figure 3.3).

3.3.4 Theoretical saturation test

We used 1/4 of the interviewees to test the theoretical saturation of this interview. Results showed that there are no new factors and the model is rich in category. Thus, the trigger factors and effects of knowledge acquisition (including external knowledge search and internal knowledge sharing) are theoretically saturated.

3.4 Summary

Through a case study, we explored the trigger factors and the effects of knowledge acquisition (including external knowledge search and internal knowledge sharing). More specifically:

(1) We explored the ambidexterity of knowledge acquisition. That is, knowledge acquisition includes external knowledge search and internal knowledge sharing. To date, most research on knowledge acquisition has focused solely on a single way of knowledge acquisition. However, according to Mina, Moreau and Alan (2014), only depending on internal or external knowledge to innovate is not enough, and enterprises should pay attention to the synergy roles of internal and external knowledge.

(2) We explored the trigger factors of knowledge acquisition such as external knowledge search and internal knowledge sharing. Results showed that the trigger factors of knowledge acquisition mainly include career-orientation, calling-for

orientation, personality, relationship perception, organizational strategy, team climate, and organization/team culture. Calling-for orientation and personality are intrinsic triggers; while career-orientation, team climate, organization/team culture, relationship perception, and organizational strategy are cognitive triggers. Further, career-orientation and calling-orientation, which are work value orientation, are dynamic elements. Personality is basic element. However, team climate, relationship perception, and organization/team culture are situational elements.

Based on the planned behavior theory (Kuo & Young, 2008), calling-orientation which is a dynamic element can influence internal knowledge sharing and knowledge search. According to Huang et al. (2010), sense of achievement plays a positive role in promoting knowledge search. In addition, material incentive and sense of achievement are also crucial to internal knowledge sharing. In addition, trust is an important factor that prompts internal knowledge sharing. For example, Smaliukiene et al. (2017) found that high interpersonal trust will lead to high level of internal knowledge sharing. Also, Bradach and Eccles (1998) argued that mutual trust can prompt internal knowledge sharing, and conflict will hinder internal knowledge sharing.

In terms of team climate, team support and team fairness will trigger internal knowledge sharing. On the one hand, a high level of perceived organizational support can facilitate learning and internal knowledge sharing, which in turn will help employees to achieve their personal and organizational goals. For example, George and Brief (1992) has suggested that perceived organizational support can help employees to implement role behaviors, such as searching related information and knowledge and putting forward constructive suggestions. On the other hand, according to impression management (Erhardt & Gibbs 2014), employees will share their knowledge with colleagues to enhance their status and reputation, because this can help them to create desired work-related impressions of professionalism, competence, and commitment (Wasko & Faraj, 2005). Further, if individuals who perceive strong organizational justice, such as they are believed to be significant,

worthy, and treated fairly by the organization, they are more likely to share knowledge with their colleagues. Thus, team support can trigger both external knowledge search and internal knowledge sharing. In addition, organization (and team) culture can prompt both knowledge search and internal knowledge sharing. More specifically, organizational (and team) learning culture can prompt external knowledge search and internal knowledge sharing, and team cooperation culture can increase internal knowledge sharing. This is because learning culture encourages individuals to acquire knowledge from both inside and outside, while team cooperation culture provides sense of security for team members and encourages team members to engage in problem solving and decision-making process, which in turn will prompt internal knowledge sharing. In addition, organizational strategy is an important factor to trigger external knowledge search. For example, Zhou and Li (2007) has shown that market orientation and entrepreneurship orientation are two opening organizational strategy. Market orientation strategy can help firms to collect and use market information to create values. However, Wu and Chen (2016) argued that organizational diversity strategy will prompt external knowledge search, while cost leading strategy will inhibit external knowledge search. Thus, organizational strategy is crucial to external knowledge search.

(3) We explored the effects and mechanisms of knowledge acquisition. More specifically, we found that external knowledge search and internal knowledge sharing can prompt creativity and innovation, which is in line with previous research (i.e. Ma et al., 2017; Soo et al., 2007). For example, Zhang et al. (2011) argued that through internal knowledge sharing and communication, more heterogeneous knowledge will be captured, which further prompts innovation. Soo et al. (2007) argued that external knowledge search can enhance creativity and prompt learning. In addition, we found that knowledge acquisition (external knowledge search and internal knowledge sharing) can promote knowledge integration and enhance absorptive capacity, which in turn will prompt team creativity. Next, we will explore the relationship between knowledge acquisition and team creativity, and examine the mediating roles of

absorptive capacity and knowledge integration.

Chapter 4: The influence mechanism of knowledge acquisition on team creativity

4.1 Research framework

Through a case study, we found that absorptive capacity and knowledge integration play important roles in prompting team creativity. Thus, in this chapter, we will explore the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and team creativity. Also, we will examine the mediating roles of absorptive capacity and knowledge integration and the moderating roles of task characteristics and environment dynamism in the relationship between knowledge acquisition and team creativity.

4.2 Theoretical hypotheses

4.2.1 Knowledge acquisition influence team creativity: The mediating role of absorptive capacity and knowledge integration.

In line with prior work (Shin & Zhou, 2007), team creativity is defined as the development of novel and useful ideas which are relevant to services, products, procedures, and processes by a team of employees working together. It requires the ability to absorb and combine previously unrelated knowledge, expertise and materials into something new and better (Drazin et al., 1999; Soo et al., 2007). In a sense, creativity and innovation often arise in the course of knowledge-acquisition behavior.

Currently, firms' incentives to increase their reliance on external knowledge for innovation have been strengthened by the growth of turbulent technology markets (Arora et al., 2001). The importance of external knowledge search has been discussed

at length in the creativity and innovation literature (Cassiman, 2006; Mina et al., 2014). For example, Gallego et al. (2013) showed that external knowledge search can assist firms in enhancing their absorptive capacity, thereby positively influencing organizational innovation. Soo et al. (2007) demonstrated that external knowledge acquisition and absorptive capacity were positively related to creativity. Yet, researchers have called for greater attention towards factors influencing team creativity (Shalley & Gilson, 2004) and examine the mediators that help to explain how external knowledge search influence intended outcomes (Soo et al., 2007).

In addition, creativity needs to think divergently and combine previously unrelated knowledge, products, or processes into something new, it is a result of the interactions of team members (Amabile, 1996; Bodla et al., 2016; Zhang et al., 2011). Research has demonstrated that knowledge sharing to be essential for team creativity (Zhang et al., 2011). According to the componential theory of creativity, creativity includes three important components: Expertise, creative-thinking skill, and intrinsic task motivation (Amabile, 1996). Research suggests that knowledge sharing is conducive to the acquisition of knowledge, expertise and skills (Huang et al., 2014). Knowledge sharing has also been shown to increase the mutual understanding of team members and facilitate the motivation to gain insights from other team members to broaden their scope of knowledge, which are important sources of team creativity (Gong et al., 2012; Huang et al., 2014). That is, with the abundant knowledge through sharing with others, team members are more likely to utilize a variety of perspectives, ideas, and expertise of other team members to generate novel and creative ideas in a context requiring creativity (Shin, 2014). Empirical evidence also suggests by sharing team members' expertise, knowledge and skills, teams can develop its creative potential (e.g. Bodla et al., 2016).

Thus, based on the above analysis, we hypothesize that:

H1: External knowledge search is positively related to team creativity.

H2: Internal knowledge sharing is positively related to team creativity.

Absorptive capacity exists as "two subsets of potential and realized absorptive

capacity (Zahra & Geogre, 2002: 185). Potential absorptive capacity that includes knowledge recognition and knowledge assimilation capabilities centers on knowledge exploration, and realized absorptive capacity focuses on knowledge transformation and exploitation (Matusik & Heeley, 2005; Zahra & Geogre, 2002). Absorptive capacity is a critical organizational ability that influences organizational outcomes (Cohen & Levinthal, 1990; Lowik et al., 2016). In particular, absorptive capacity is vital to innovation (Cohen & Levinthal, 1990). The literature on absorptive capacity suggests that through improving the level of absorptive capacity, employees can connect previously unconnected knowledge and ideas, and thus create new knowledge (Kogut & Zander, 1993). Empirical research suggests that a certain level of absorptive capacity can stimulate innovation (e.g. Cohen & Levinthal, 1990; Lichtenthaler & Lichtenthaler, 2009; Lowik et al., 2016).

While innovation is different from creativity, it encompasses idea generation (i.e. creativity) and idea implementation (Somech & Drach-Zahavy, 2013). Thus, there is no reason to believe that absorptive capacity has a different relationship with creativity. Through improving the level of absorptive capacity, team members not only bring different bodies of related knowledge, but also improve their ability to explore new knowledge and exploit existing knowledge (Cohen & Levinthal, 1990; Zahra & Geogre, 2002). Drawing on componential theory of creativity (Amabile, 1996), both the broader pool of related knowledge and enhanced ability of the team members, which prompt knowledge exploration and exploitation, provide cognitive resources for team creativity (Gong et al., 2013). So we argue that there is a positive relationship between absorptive capacity and team creativity.

According to Minbaeva et al.'s study (2003), absorptive capacity includes two elements: prior knowledge (employees' ability) and intensity of effort (employees' motivation). Potential absorptive capacity is expected to have a high content of employees' ability while realized absorptive capacity is expected to have a high content of employees' motivation (Liao et al., 2007; Minbaeva et al., 2003). Previous research has suggested that internal knowledge sharing has a positive effect on

absorptive capacity (e.g. Costal & Monteiro, 2016; Lee, Lee & Park, 2014; Liao et al., 2007). For example, Liao et al.'s (2007) research has shown that in a knowledge sharing context, team members are more likely to share their knowledge with colleagues, which in turn will improve their learning ability and enhance motivation to perform effectively. More specifically, through the process of interacting with colleagues (e.g., internal knowledge sharing), team members can increase their related knowledge and revamp their knowledge stock (Liao et al., 2007). Research on memory development suggests that accumulated prior knowledge can increase both employees' ability to acquire knowledge and employees' motivation to deploy knowledge (Cohen & Levinthal, 1990; Liao et al., 2007; Minbaeva et al., 2003). Consequently, internal knowledge sharing has a positive relationship with employees' absorptive capacities. Simultaneously, according to Cohen and Levinthal (1990), a team's absorptive capacity will depend on the absorptive capacities of its team members (Lowik et al., 2016). Thus, we argue that internal knowledge sharing has an important effect on team absorptive capacity.

In addition, external knowledge search can also influence absorptive capacity. On the one hand, external knowledge search influences knowledge diversity. Based on search behavior characteristics, Katila and Ahuja (2002) developed the concepts of breadth—the number of external sources or search channels, and depth—the extent to which organizations draw deeply from different external sources or search channels. Studies in this area have shown that the breadth and depth of external knowledge search can enhance the diversity and abundance of knowledge (Todtling & Asheim, 2013). Further, diversity of these knowledge sources can significantly influence the recognition and assimilation capabilities (Zahra & George, 2002), which contributes to the development of absorptive capacity. On the other hand, external knowledge search should be associated with categories built on the degree of technological distance between the team's knowledge base and the source spanned. It allows team members to develop new applications for internal knowledge (Rosenkopf & Nerkar, 2001), and broadens a team's existing knowledge base (Rosenkopf & Nerkar, 2001).

Indeed, Zahra and George (2002) found that absorptive capacity was based on prior related knowledge and investment in the development of its constituents, that is, the ability to evaluate and utilize outside knowledge is largely a function of prior knowledge base, which represents the accumulation of past knowledge and emphasizes the importance of firms' decisions about knowledge acquisition. External knowledge search may broaden a team's knowledge base, thereby enhancing absorptive capacity and, in turn, positively impacting team creativity.

Based on the above analysis, we argue that external knowledge search and internal knowledge sharing is likely to influence team creativity through absorptive capacity. That is, Absorptive capacity plays a mediating role in the relationship between internal knowledge sharing and team creativity as well as in the relationship between external knowledge search and team creativity. Thus, we hypothesize that:

H3. Absorptive capacity will mediate the relationship between external knowledge search and team creativity.

H4. Absorptive capacity will mediate the relationship between internal knowledge sharing and team creativity.

From the perspective of process, knowledge integration is the second mechanism by which internal knowledge sharing influences team outcomes. The purpose of knowledge integration is to create new architectural knowledge by combining various types of component knowledge existing in the organization (Boer et al., 1999). More particularly, knowledge integration can use three types of capabilities to combine component knowledge. System capabilities, which are associated with the directions, policies, and manuals, can create new architectural knowledge through rules and procedures (Khandwalla, 1977). Coordination capabilities relevant to the relations among team members can create new architectural knowledge through participation and training (Boer et al., 1999). Socialization capabilities, which refer to understanding rules for appropriate action, can create new architectural knowledge through cultural institutions, such as norms and values. Furthermore, according to componential theory of creativity (Amabile, 1996), exploring new architectural

knowledge can prompt team members to develop creative and novel ideas, thereby facilitating team creativity (Mcadam, 2004; Cremades, Balbastre-Benavent & Domínguez, 2015). Söderlund and Bredin's (2011) study also suggested that knowledge integration is the primary source of promoting team effectiveness in terms of creativity.

We argue that external knowledge search and internal knowledge sharing positively influence knowledge integration. Further knowledge integration influences team effectiveness (i.e. team creativity). Thus, we expect knowledge integration to mediate the relationship between internal knowledge sharing and team creativity, as well as the relationship between external knowledge search and team creativity.

In line with previous studies, we think that internal knowledge sharing and knowledge integration are closely linked but distinct processes (Bao et al., 2015). According to Nonaka's (1994) knowledge creation model, knowledge integration involves team members to exchange and combine explicit knowledge through exchange mechanisms (Nonaka, 1994). Namely, internal knowledge sharing can be viewed as a necessary condition for knowledge integration, because internal knowledge sharing nourishes knowledge integration only when team members are willing to share knowledge with other team members (Bao et al., 2015). More specifically, different individuals have specialized component knowledge, in order to integrate diverse individual knowledge and expertise into cognitive structures, team members need to connect it with existing component knowledge (Moon, 1999). In that respect, internal knowledge sharing among team members with diverse expertise and knowledge will be a very valuable source of knowledge integration. It can enrich the component knowledge by sharing knowledge and experience with other team members, which will enhance the efficiency, scope, and flexibility of knowledge integration, thereby facilitating knowledge integration. Sankowska and Söderlund (2015) also indicated that internal knowledge sharing will result in knowledge integration if it effectively combines the existing component knowledge located within the team.

In addition, knowledge integration pertains to the combination of existing knowledge with knowledge that belongs to external sources. Integrating the existing component knowledge leads to a new knowledge configuration for the involved firm. Kogut and Zander's (2002) research indicated that new knowledge is the product of an organization's integration capabilities by generating new applications from existing knowledge. The external knowledge search plays an important role in promoting an organization's knowledge integration. Searching external knowledge from clients, suppliers, and universities or even competitors can enrich component knowledge, which lies at the bottom of the knowledge hierarchy, such as knowledge relevant to products, markets and production processes. In turn, the acquisition of component knowledge can enhance the efficiency of knowledge integration (Grant, 1996). Boer et al. (1999) confirmed that the rate of knowledge integration depends on an organization's external knowledge and experience in recruiting scientific and technological talents and forming alliances.

Based on the above analysis, we argue that external knowledge search and internal knowledge sharing can affect a team's creativity through knowledge integration, that is, knowledge integration plays a mediating role in the relationship between internal knowledge sharing and team creativity as well in the relationship between knowledge search and team creativity. Thus, we hypothesize that:

H5：Knowledge integration plays a mediating role in the relationship between external knowledge search and team creativity.

H6：Knowledge integration plays a mediating role in the relationship between internal knowledge sharing and team creativity.

Absorptive capacity and knowledge integration are important factors in the process of improving team creativity, while absorptive capacity and knowledge integration are not isolated, absorptive capacity can promote knowledge integration to some extent. Absorptive capacity emphasizes on recognizing, grasping and utilizing external innovation opportunity, with strong absorptive capacity, the organization will easily analyze external environment, have more opportunity to introduce the

knowledge of competitor to promote knowledge integration. Frost and Zhou's (2005) research found that for the enterprise spread development, absorption capacity and social capital were effective factors to influence R&D cooperation and knowledge integration; it increases the likelihood of knowledge integration in multinationals with dispersed R&D.

Tzabbar et al's (2013) research found that the familiarity with the strategic partners can encourage knowledge transfer through absorptive capacity and trust, but the transferred knowledge should be integrated with existing knowledge structure to exert its effect. Li and Yang's research (2012) confirmed that the knowledge integration in small and mid-sized enterprise depends on its absorptive capacity. That is, absorptive capacity is conducive to knowledge integration. Thus, we hypothesize that:

H7. Absorptive capacity will relate positively to knowledge integration.

4.2.2 The synergy of knowledge acquisition: The interaction effects between internal knowledge sharing and knowledge search

Some scholars have examined the influencing factors of absorptive capacity and knowledge integration from the perspective of team learning. On the one hand, Chang et al.'s (2013) study shows that team absorptive capacity relies on individual absorptive capacity, and team learning can prompt absorptive capacity. According to Minna et al. (2016), internal knowledge sharing, which is collective behavior, can promote communication and team collective learning. Thus, internal internal knowledge sharing has an important influence on absorptive capacity. Zahra and George's (2002) study also confirmed that absorptive capacity derives from organization knowledge base and previous experience, and internal knowledge sharing provide team members with some tacit knowledge such as experience. At the same time, internal knowledge sharing can provide team members with some explicit knowledge, such as conventions, rules, which in turn will enrich team knowledge base

and prompt absorptive capacity. On the other hand, Boer et al. (1999) argued that the purpose of knowledge integration is to create new architectural knowledge by using different types of component knowledge. According to Grant (1996), knowledge integration has three characteristics: scope, efficiency and flexibility. Efficiency of knowledge absorption is defined as "how firms identify, assimilate, and exploit knowledge from a cost and economies of scale perspective" (Van den Bosch et al., 1999: 552). Scope of knowledge absorption is defined as "the breadth of component knowledge a firm draws upon" (Van den Bosch et al., 1999: 552). Flexibility of knowledge absorption refers to "the extent to which a firm can access additional, and reconfigure existing, component knowledge" (Van den Bosch et al., 1999: 552).

However, to date, few scholars have examined the moderating role of internal knowledge sharing in the relationship between external knowledge search and absorptive capacity, as well in the relationship between external knowledge search and knowledge integration. Prior work has suggested that knowledge sharing can play an important moderating role in the relationship between inputs and outcomes. For example, Huang et al. (2014) found that team knowledge sharing activities and individual team members' expertise dissimilarity jointly predict individual creativity (Huang et al., 2014). Indeed, external knowledge search can help team members to acquire different experiences and knowledge, which in turn will enhance team members' expertise dissimilarity (Chen, Chen & Vanhaverbeke, 2011). Consequently, when external knowledge search promotes knowledge integration and improve absorptive capacity within the team, internal knowledge sharing can strengthen the relationship. More specifically, when teams have a high level of internal knowledge sharing, external knowledge search is more likely to promote knowledge integration and improve absorptive capacity. Based on the above analysis, we hypothesize that:

H12: Internal knowledge sharing moderates the relationship between external knowledge search and absorptive capacity.

H13: Internal knowledge sharing moderates the relationship between external knowledge search and knowledge integration.

4.2.3 The moderating role of environmental dynamism

Environmental dynamism, defined as the level of environmental instability, change and uncertainty (Dess & Beard, 1984), such as changes in technologies and fluctuations in supply of materials or product demand (Jansen, Van & Volberda, 2006), has been highlighted as a contextual moderator in literatures of external knowledge search(Cruz-González et al., 2015) and absorptive capacity (Roberts, 2015). By intension, we argue that, environmental dynamism strengthens the positive effect of external knowledge search on absorptive capacity, and, in turn, team creativity, and strengthens the positive effect of external knowledge search on knowledge integration, and, in turn, team creativity.

First, organizational units that operate in dynamic environments are required to have search abilities that are sensitive to the technological environment (Wallace, Little, Hill, & Ridge, 2010). As Cruz-González et al. (2015) noted, in highly dynamic environments, teams need to reconfigure their knowledge-base quickly because prior knowledge becomes rapidly obsolete. External knowledge search facilitates the flow of knowledge, and the searched knowledge can be more effectively mobilized for creative outcomes in dynamic environments, while in stable environments, teams rely on existing knowledge and skills and require less external knowledge. Second, the highly dynamic the environments, the less likely any teams will have the requisite knowledge to response to the frequent technological paradigm (Schilke, 2014). In highly dynamic environment, external knowledge search is more likely to prompt team members to access other teams or organizations who have the requisite knowledge, thereby providing raw materials for knowledge integration (Tzabbar, Aharonson, & Amburgey, 2013). Also, in highly dynamic environment, external knowledge search is more likely to enhance team members' knowledge diversity (Zahra & George, 2002), which in turn will influence team members' abilities to recognize, assimilate, and exploit knowledge (Cruz-González et al., 2015). In general, in highly dynamic environments, external knowledge search allows team members to

mobilize the external knowledge to enhance absorptive capacity and facilitate knowledge integration, thereby improving team creativity. Thus, we hypothesize:H3a: Environmental dynamism moderates the relationship between external knowledge search and absorptive capacity. The higher the environmental dynamism, the more positive the relationship will be.

H8: Environmental dynamism moderates the relationship between external knowledge search and absorptive capacity. The higher the environmental dynamism, the more positive the relationship will be.

H9: Environmental dynamism moderates the relationship between external knowledge search and knowledge integration. The higher the environmental dynamism, the more positive the relationship will be.

However, according to the ambidexterity theory of organization (Koryak et al., 2018), external knowledge search and internal knowledge sharing are two main ways of knowledge acquisition. However, due to the limited resources, these two behaviors will compete for scarce resources. Namely when organizations devote more resources to searching external knowledge, fewer resources will be used to share knowledge. In highly dynamic economic environment, enterprises will put more effort in searching external knowledge and pay little attention to share knowledge. Thus, we propose that:

H10: Environmental dynamism moderates the relationship between internal knowledge sharing and absorptive capacity. The higher the environmental dynamism, the less positive the relationship will be.

H11: Environmental dynamism moderates the relationship between internal knowledge sharing and knowledge integration. The higher the environmental dynamism, the less positive the relationship will be.

4.2.4 The moderating role of task characteristics: Task interdependence and task complexity

The importance of task interdependence, defined as the degree to which individual team members depend on and receive direct support of others to accomplish their work effectively (Bachrach, Powell & Bendoly, 2006; Van der Vegt & Janssen, 2003; Welbourne & Sariol, 2017), has been highlighted as a contextual moderator in literatures of knowledge management (Staples & Webster, 2008), and creativity (Hon & Chan, 2013). By intention, the relationship between absorptive capacity (knowledge integration) and team creativity should be moderated by task interdependence for two reasons.

First, interdependent tasks require team members to engage in sequential and reciprocal exchanges to carry out the team tasks (Joshi & Roh, 2009). It can increase the importance of internal knowledge sharing, helping and cooperation requirements among team members (Mueller & Kamdar, 2011; Staples & Webster, 2008), which in turn will prompt team members' willingness to integrate and combine diverse perspectives into novel ideas (Van der Vegt & Janssen, 2003). Second, when team members work under conditions of high task interdependence, they will experience extensive mutual learning and high-quality social processes and use the learned knowledge to solve problems. That is, absorptive capacity and knowledge integration, resulting from high task interdependence, will prompt the generation of creative ideas, and stimulate and enable team members to generate synergistic solutions (Van der Vegt & Janssen, 2003). Thus, task interdependence will likely strengthen the positive relationship between team learning and team creativity. Thus, we hypothesize that:

H14: Task interdependence will moderate the relationship between absorptive capacity and team creativity. The higher the task interdependence is, the more positive the relationship will be.

H15: Task interdependence will moderate the relationship between absorptive capacity and team creativity. The higher the task interdependence is, the more positive

the relationship will be.

Task complexity is defined as the extent to which a task involves high cognitive demand, low routine, and uncertainty (Herold, 1978); it has also been highlighted as a contextual moderator in the literature of creativity and innovation (Taggar, 2002). Simultaneously, team learning theory assumes a complex task environment (Kukenberger, Mathieu & Ruddy, 2015). Accordingly, the relationship between knowledge acquisition and team creativity, via absorptive capacity and knowledge integration would be strengthened when the task is relatively complex. Thus, we believe that absorptive capacity and knowledge integration are more likely to effectively prompt team creativity under high task complexity than under low task complexity. On the one hand, complex tasks involve team members to generate alternative approaches and solutions where none readily exists (Jia et al., 2014). Non-routine and complex tasks underline the importance of knowledge exchange and knowledge processing requirements among team members (Tushman, 1979). Absorptive capacity and knowledge integration increase the work-related knowledge, information and skills of team members, which can be used for complex tasks, while simple tasks involve less reflective communication (Gibson & Vermeulen, 2003; Hirst, Knippenberg & Zhou, 2009). On the other hand, the more complex the tasks are, the less likely any individual team member will have all the related knowledge. Absorptive capacity and knowledge integration prompts team members to acquire the related knowledge for generating creative solutions to complex tasks (Hirst, Knippenberg & Zhou, 2009). That is, task complexity will likely enhance the positive relationship between absorptive capacity (knowledge integration) and team creativity. Thus, we hypothesize that:

H16: Task complexity will moderate the relationship between absorptive capacity and team creativity. The higher the task complexity is, the more positive the relationship will be.

H17: Task complexity will moderate the relationship between knowledge integration and team creativity. The higher the task complexity is, the more positive

the relationship will be.

As we note, each boundary condition is crucial for the effects of absorptive capacity and knowledge integration, both task complexity and task interdependence may have their unique influences on team creativity. Thus, it is important to explore the joint moderating effects on the relationship between absorptive capacity (knowledge integration) and team creativity. Although both task complexity and task interdependence are likely to have positive moderating effects on team creativity, each one alone may not optimize team creativity. That is, lacking either one of them may lead to a neutralized relationship between absorptive capacity (knowledge integration) and team creativity.

When task complexity is high, but task interdependence is low, individual team members will take less time to share their personal experience, know-how, and specialized skills with the team (Staples & Webster, 2008; Mueller & Kamdar, 2011), thereby influencing team creativity. Similarly, when task interdependence is high but task complexity is low, team members will have the requisite task information and knowledge (Hirst, Knippenberg & Zhou, 2009). In turn, this will inhibit absorptive capacity and knowledge integration, thereby influencing team creativity. Thus, the highest level of team creativity occurs when levels of both task complexity and task interdependence are high, low levels of either or both task characteristics may represent the disconnection between absorptive capacity (knowledge integration) and team creativity. Thus, we hypothesize that:

H18: Task complexity and task interdependence jointly moderate the relationship between absorptive capacity and team creativity, such that the relationship is the most positive when both task complexity and task interdependence are high.

H19: Task complexity and task interdependence jointly moderate the relationship between knowledge integration and team creativity, such that the relationship is the most positive when both task complexity and task interdependence are high.

Our research model for this study is shown in Figure 4.1.

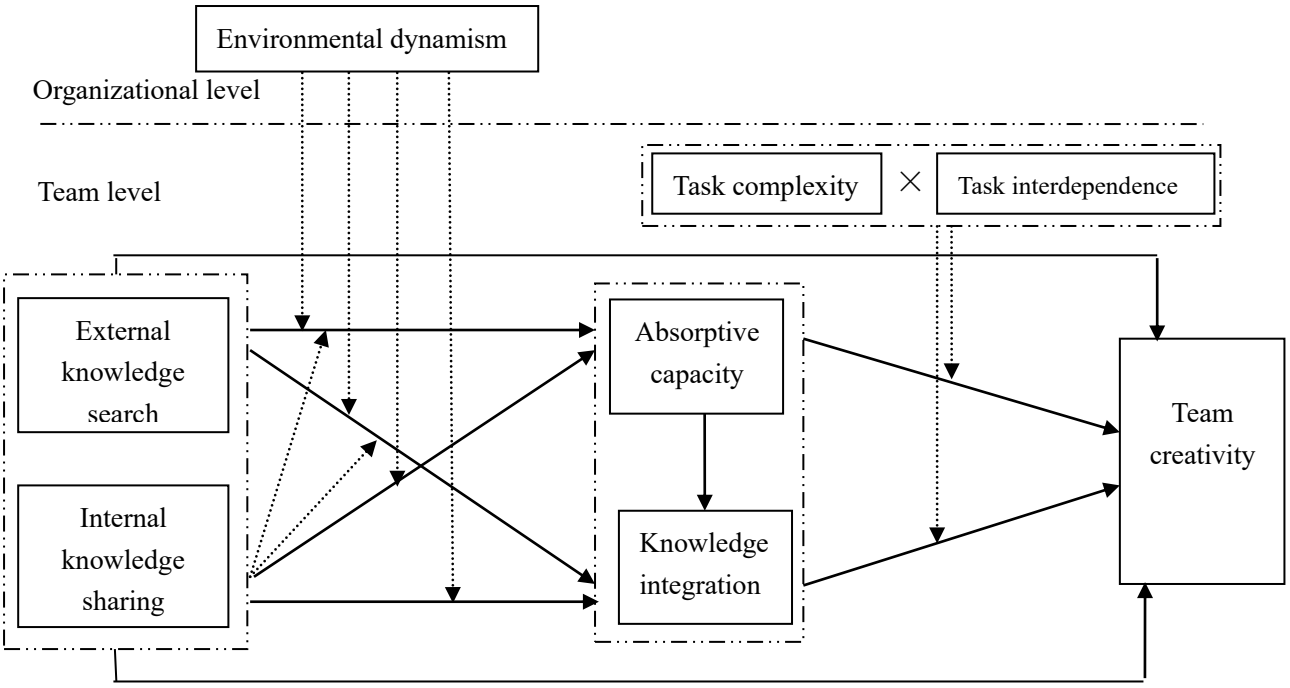


Figure 4.1 Research hypotheses

Chapter 5: Questionnaire design and small sample test

In this chapter, we will examine how knowledge acquisition (including external knowledge search and internal knowledge sharing) affects team creativity. More specifically, we will explore the mediating roles of absorptive capacity and knowledge integration in the relationship between knowledge acquisition and team creativity. Also, we will explore the moderating roles of task characteristics and environmental dynamism in the relationship between knowledge acquisition and team creativity.

5.1 Questionnaire design

In this study, we adopted mature scales because they have high reliability and validity. In addition, the scales of task complexity and task interdependence were initially written in English, and we translated them into Chinese using the back-translation procedure (Brislin, 1986). More specifically, all translators were blind to the study's hypotheses, and two bilingual individuals independently translated the survey from English to Chinese. There was 84 percent agreement between the translators regarding word choice and expression. A third bilingual translated the survey back to English. Response to all the measures were made on a 5-point Likert-type scale, ranging from 1=strongly disagree (a very little extent) to 5=strongly agree (a very large extent).

In addition, participation was voluntary, and respondents were assured of the anonymity of their responses. To avoid common method bias, we collected data with two separate questionnaires: One for the subordinates who assessed internal knowledge sharing, external knowledge search, absorptive capacity, knowledge integration, task complexity, and task interdependence and the other for their supervisors, who assessed team creativity, and environmental dynamism.

5.2 Measures

External Knowledge Search. We measured absorptive capacity using Hu and Fang's (2013) four-item scale, including external knowledge search breadth and external knowledge search depth. Sample items included "Our team can search the required knowledge from a variety of channels (such as mediums and methods)" and "Our team can deeply extract the required knowledge from what we searched".

Absorptive Capacity. We measured absorptive capacity using Li and Yang's (2014) thirteen-item scale, including potential absorptive capacity and realized absorptive capacity. Sample items included "Our team has a strong ability to identify the value of diverse knowledge" and "Our team quickly recognizes the usefulness of new external knowledge to existing knowledge".

Knowledge Integration. We measured knowledge integration using Chen et al.'s (2008) thirteen-item scale. A sample item is "Our team members analyze relevant information and knowledge according to the standard of work and procedure".

Internal Knowledge Sharing. We measured knowledge sharing using Huang et al.'s (2014) five-item scale, including explicit knowledge sharing and tacit knowledge sharing. Explicit knowledge sharing was measured in the current study using two items; a sample item is "I provide my methodologies, manuals, and models for members of this time". Tacit knowledge sharing was measured using three items; a sample item is "I share my experience or know-how from work with members in this team frequently".

Team Creativity. We measured team creativity using Wang and Luo's (2012) twelve-item scale. Sample items included "Team members often come up with some practical solutions to solve problems" and "Team members often come up with new ways and methods to solve problems".

Environmental Dynamism. We measured environmental dynamism using the four-item scale employed by We measured environmental dynamism using Wang and Chen's (2011) four-item scale. A sample item is "The degree of change of enterprise external environment is very severe".

Task Interdependence. We measured task interdependence using a five-item scale instrument developed by Van der Vegt and Janssen's (2003). A sample item is "I regularly have to communicate with colleagues about work-related issues".

Task Complexity. We measured task complexity using a three-item scale instrument developed by Dean and Snell (1991). A sample item is "I regularly have to communicate with colleagues about work-related issues".

Control Variables. We included several control variables in the statistical analyses. Followers' educational level and job tenure were control variables of this study since they are related to creativity. Creativity is the outcome of an individual's accumulated creative thinking skills and expertise based on formal education and past experience (Amabile, 1997). Experience provides a level of familiarity that might be needed for creative performance (Gilson & Shalley, 2004); therefore, job tenure was used as an indicator of experience.

5.3 A small sample test

5.3.1 Samples

In this chapter, we will examine the quality of the scales through a small sample test. Data were collected from subordinates and their supervisors from 40 knowledge worker teams (such as project team and R&D team) in Chinese high-technology organizations located in the eastern part of China. The final sample used in the analyses comprised 163 employee-supervisor matched questionnaires and 36 teams (see Tables 5.1 and 5.2).

Table 5.1 Descriptive statistics (Individual) (N=163)

Variables	Type	Samples	Percentage
Gender	Male	107	65.64%
	Female	56	34.36%
	25	34	20.86%

Age	25-35	83	50.92%
	36-45	27	16.56%
	45	19	11.66%
Education level	Junior colleague or below	21	12.88%
	Bachelor	76	46.63%
	Master	43	26.38%
	Doctor	23	14.11%
Tenure	3	46	28.22%
	3-10	63	38.65%
	11-20	33	20.25%
	Above 20	21	12.88%

Table 5.1 presents descriptive statistics at individual level. As shown in the table, 65.64% were male; their age mainly focuses on 25-35, and their job tenure mainly focuses on 3-10 years; 12.88% had had junior colleague diplomas or below, 46.63% had bachelor's degrees, 26.38% had master's degrees, and 14.11% had PhDs.

Table 5.2 Descriptive statistics (Teams) (N=36)

Variables	Type	Samples	Percentage
Team size	Below 10	6	16.67%
	11-20	18	50.00%
	Above 20	12	33.33%
Team age	3	5	13.89%
	3-5	17	47.22%
	5	14	38.89%

Table 5.2 presents descriptive statistics at the team level. As shown in the table, team size is mainly focused on 11-20, and team tenure mainly focuses on 3-5 years.

5.3.2 Analysis

Reliability analysis

We conducted CITC to examine internal consistency reliability. More specifically, if the value of CITC is less than 0.3, we will delete the measurement item; if the value of CITC is between 0.3 and 0.5, and removing one item can increase the overall value of Cronbach alpha coefficient(such as exceeding 0.70), we will delete this item (Churchill & Surprenant, 1982).

Exploratory factor analysis is to classify the comprehensive evaluation of the original variables. Before conducting exploratory factor analysis, we performed the KMO and Bartlett test. KMO value ranges from 0 to 1. If KMO value is above 0.9, it will be very suitable for exploratory factor analysis. If KMO value ranges from 0.8 to 0.9, it will be a good fit for exploratory factor analysis; If KMO value ranges from 0.7 to 0.8, it will be appropriate for exploratory factor analysis; If KMO value ranges from 0.6 to 0.7, it will be not very suitable for exploratory factor analysis; If KMO value ranges from 0.5 to 0.6, it will be reluctant for exploratory factor analysis; and if KMO value is below 0.5, it is not suitable for exploratory factor analysis. In this study, we adopt the principal component analysis (PCA) method to extract the items. More specifically, the eigenvalues are greater than 1 as the standard of factor extraction.

5.3.3 Results

As shown in Table 5.3, the CITC values of the four items of knowledge search are 0.671, 0.737, 0.748, and 0.671 respectively, which are greater than 0.5. In addition, the Cronbach alpha coefficient of external knowledge search is 0.858, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.3 CITC and internal consistency reliability analysis (External knowledge search)

Item	CITC	α (if deleting this item)	α
EKS1	0.671	0.834	0.858
EKS2	0.737	0.804	
EKS3	0.748	0.801	
EKS4	0.661	0.836	

As shown in Table 5.4, the KMO value of external knowledge search is 0.801,

which is greater than 0.7, and the Bartlett sphere value of external knowledge search is 152.275 ($p<0.01$). Thus, this scale is suitable for factor analysis. Further, we conduct principal component analysis (PCA) to extract the items. Results showed that the accumulated variance of two dimensions of external knowledge search accounts 83.274%, which is greater than 50%. Thus, external knowledge search can be divided into knowledge search depth and width. In addition, the item load values of EKS1, EKS2, EKS3, and EKS4 are greater than 0.5., and there are no cross-loading measurement items. Thus, it is not necessary to delete any items.

Table 5.4 Factor analysis of external knowledge search

Items	Factor 1	Factor 2
EKS1	**0.893**	0.245
EKS2	**0.777**	0.433
EKS4	0.247	**0.912**
EKS3	0.501	**0.735**
Eigenvalue	2.815	1.516
Explaining variance ratio	70.377%	12.898%
Accumulation	70.377%	83.274%
KMO	0.801	
Bartlett	152.275	
Significance	0.000	

As shown in Table 5.5, the CITC values of the five items of internal knowledge sharing are 0.657, 0.519, 0.503, 0.612, and 0.527 respectively. In addition, the Cronbach alpha coefficient of internal knowledge sharing is 0.770, which is greater than 0.7. Thus, this scale has a good reliability.

Table 4.5 CITC and internal consistency reliability analysis (internal knowledge sharing)

Item	CITC	α (if deleting this item)	α
KS1	0.657	0.667	0.770
KS2	0.519	0.742	
KS3	0.503	0.750	
KS4	0.612	0.694	

KS5	0.427	0.792	

As shown in Table 5.6, the KMO value of internal knowledge sharing is 0.783, and the Bartlett sphere value of internal knowledge sharing is 93.964 ($p<0.01$). Results showed that the scale is suitable for factor analysis. Further, we adopt the principal component analysis (PCA) method to extract the items. Results showed that the accumulated variance of two dimensions of internal knowledge sharing accounts 76.311%, which is greater than 50%. Thus, internal knowledge sharing can be divided into explicit knowledge sharing and tacit knowledge sharing. In addition, the item load values of KS1, KS2, KS3, KS4, and KS5 are greater than 0.5, and there are no cross-loading measurement items. Thus, it is not necessary to delete any items.

Table 5.6 Factor analysis of internal knowledge sharing

Items	Factor1	Factor2
KS3	**.832**	.144
KS4	**.803**	.314
KS5	**.786**	.352
KS2	.137	**.918**
KS1	.489	**.704**
Eigenvalue	2.671	1.381
Explaining variance ratio	59.274%	17.037%
Accumulation	59.274%	76.311%
KMO	0.783	
Bartlett ($\chi 2$)	93.964	
Significance	0.000	

As shown in Table 5.7, the CITC values of the thirteen items of absorptive capacity are greater than 0.5. In addition, the Cronbach alpha coefficient of absorptive capacity is 0.887, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.7 CITC and internal consistency reliability analysis (Absorptive capacity)

Item	CITC	α (if deleting this item)	α
AC1	0.524	0.881	
AC2	0.527	0.881	

AC3	0.556	0.879	
AC4	0.538	0.880	
AC5	0.562	0.879	
AC6	0.544	0.880	0.887
AC7	0.602	0.877	
AC8	0.585	0.878	
AC9	0.653	0.874	
AC10	0.507	0.882	
AC11	0.584	0.878	
AC12	0.645	0.875	
AC13	0.645	0.875	

As shown in Table 5.8. The KMO value of absorptive capacity is 0.856, and the Bartlett sphere value of absorptive capacity is 569.625 ($p<0.01$). Results showed that the scale is suitable for factor analysis. Further, we adopt the principal component analysis (PCA) method to extract the item. Results showed that the accumulated variance of two dimensions of absorptive capacity accounts 58.348%, which is greater than 50%. Thus, absorptive capacity can be divided into potential absorptive capacity and realized absorptive capacity. In addition, the item load values of AC1-AC13 are greater than 0.5, and there are no cross-loading measurement items. Thus, it is not necessary to delete any measurement items.

Table 5.8 Factor analysis of absorptive capacity

Items	Factor1	Factor2
AC12	**0.889**	0.130
AC13	**0.889**	0.130
AC11	**0.739**	0.198
AC10	**0.730**	0.101
AC9	**0.681**	0.346
AC8	**0.636**	0.301
AC5	0.069	**0.834**

AC3	0.077		**0.818**
AC7	0.217		**0.737**
AC6	0.152		**0.725**
AC2	0.206		**0.649**
AC1	0.285		**0.553**
AC4	0.333		**0.535**
Eigenvalue	5.532		2.054
Explaining variance ratio	42.551%		15.797%
Accumulation	42.551%		58.348%
KMO		0.856	
Bartlett (χ2)		569.625	
Significance		0.000	

As shown in Table 5.9, the CITC values of thirteen items of knowledge integration are greater than 0.5. In addition, the Cronbach alpha coefficient of absorptive capacity is 0.893, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.9 CITC and internal consistency reliability analysis (Knowledge integration)

Item	CITC	α (if deleting this item)	α
KI1	0.553	0.887	
KI2	0.591	0.885	
KI3	0.671	0.881	
KI4	0.714	0.879	
KI5	0.550	0.887	
KI6	0.478	0.891	
KI7	0.458	0.891	0.893
KI8	0.589	0.885	
KI9	0.531	0.888	
KI10	0.622	0.884	
KI11	0.596	0.885	
KI12	0.609	0.884	
KI13	0.701	0.880	

As shown in Table 5.10, the KMO value of knowledge integration is 0.840, and

the Bartlett sphere value of knowledge integration is 639.911 ($p<0.01$). Results show that this scale is suitable for factor analysis. Further, we adopt the principal component analysis (PCA) to extract the items. Results showed that the accumulated variance of two dimensions of knowledge integration accounts 63.283%, which is greater than 50%. Thus, knowledge integration can be divided into system process, coordination process, and socialization process. The item load values of KI1-KI13 are greater than 0.5, and there are no cross-loading measurement items. Thus, it is not necessary to delete any measurement items.

Table 5.10 Factor analysis of knowledge integration

Items	Factor1	Factor2	Factor3
KI3	**0.866**	0.332	0.093
KI4	**0.839**	0.372	0.141
KI2	**0.729**	0.020	0.396
KI1	**0.575**	0.078	0.426
KI11	0.187	**0.867**	0.113
KI12	0.085	**0.737**	0.359
KI10	0.163	**0.715**	0.327
KI13	0.434	**0.703**	0.194
KI9	0.118	0.160	**0.770**
KI6	0.160	0.173	**0.621**
KI5	0.347	0.152	**0.582**
KI7	0.091	0.254	**0.575**
KI8	0.305	0.278	**0.562**
Eigenvalue	5.764	1.295	1.168
Explaining variance ratio	44.337%	9.960%	8.986%
Accumulation	44.337%	54.297%	63.283%
KMO		0.840	
Bartlett ($\chi 2$)		639.911	
Significance		0.000	

(5) The reliability analysis of team creativity.

As shown in Table 5.11, the CITC values of 12 items of team creativity are greater than 0.5. In addition, the Cronbach alpha coefficient of team creativity is 0.895, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.11 CITC and internal consistency reliability analysis (Team creativity)

Item	CITC	α (if deleting this item)	α
TC1	0.563	0.890	0.895
TC2	0.672	0.883	
TC3	0.617	0.886	
TC4	0.669	0.883	
TC5	0.764	0.878	
TC6	0.459	0.895	
TC7	0.592	0.888	
TC8	0.663	0.885	
TC9	0.621	0.886	
TC10	0.512	0.892	
TC11	0.702	0.882	
TC12	0.517	0.891	

As shown in Table 5.12, the KMO value of team creativity is 0.746, which is greater than the critical value of 0.7, and the Bartlett sphere value of external knowledge search is 398.45 ($p<0.01$). Results showed that the scale is suitable for factor analysis. Further, we adopt the principal component analysis (PCA) to extract the items. Results showed that the accumulated variance of two dimensions of team creativity accounts for 71.930%, which is greater than 50%. Thus, team creativity can be divided into novelty and practicality. In addition, the item load values of TC1-TC12 are greater than 0.5, and there are no cross-loading measurement items. Thus, it is not necessary to delete any measurement items.

Table 5.12 Factor analysis of team creativity

Items	Factor1	Factor2
TC9	**0.915**	0.102

TC8	**0.910**		0.144
TC10	**0.876**		0.002
TC11	**0.861**		0.240
TC12	**0.782**		0.086
TC7	**0.646**		0.301
TC5	0.220		**0.913**
TC4	0.140		**0.883**
TC3	0.129		**0.832**
TC2	0.235		**0.786**
TC6	-0.027		**0.772**
TC1	0.141		**0.749**
Eigenvalue	5.714		2.918
Explaining variance ratio	47.614%		24.316%
Accumulation	47.614%		71.930%
KMO		0.746	
Bartlett (χ2)		398.450	
Significance		0.000	

(5) The reliability analysis of environment dynamism

As shown in Table 5.13, the CITC values of four items of environment dynamism are greater than 0.5. In addition, the Cronbach alpha coefficient of environment dynamism is 0.920, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.13 CITC and internal consistency reliability analysis (Environmental dynamism)

Item	CITC	α (if deleting this item)	α
ED1	0.731	0.925	0.920
ED2	0.890	0.872	
ED3	0.783	0.910	
ED4	0.883	0.873	

(6) The reliability analysis of task interdependence

As shown in Table 5.14, the CITC values of 5 items of task interdependence are

greater than 0.5. In addition, the Cronbach alpha coefficient of task interdependence is 0.860, which is greater than 0.7. Thus, the scale has a good reliability.

Table 5.14 CITC and internal consistency reliability analysis (Task interdependence)

Item	CITC	α (if deleting this item)	α
TI1	0.646	0.839	
TI2	0.699	0.826	
TI3	0.628	0.844	0.860
TI4	0.737	0.815	
TI5	0.680	0.831	

(5) The reliability analysis of task complexity

As shown in Table 5.15, the CITC values of three items of task complexity are greater than 0.5. In addition, the Cronbach alpha coefficient of task complexity is 0.791, which is greater than 0.7. Thus, this scale has a good reliability.

Table 5.15 CITC and internal consistency reliability analysis (Task complexity)

Item	CITC	α (if deleting this item)	α
TCo1	0.671	0.693	
TCo2	0.664	0.680	0.791
TCo3	0.588	0.781	

5.4 Summary

In this chapter, we designed questionnaires and performed a small sample test. More specifically, we collected data with two separate questionnaires: Employees assessed internal knowledge sharing, external knowledge search, absorptive capacity, knowledge integration, task complexity, and task interdependence; and their supervisors assessed team creativity, and environmental dynamism. In addition, we conducted CITC analysis and exploratory factor analysis to examine the internal consistency reliability of these variables.

Chapter 6: A large-sample survey and hypotheses testing

In this Chapter, we test our research hypotheses with a large-sample survey. First, samples are described; second, the reliability and validity of the data are analyzed; third, structural equation model is used to test our research model.

6.1 Samples

The first formal survey began in December in 2013 and ended in June in 2015. At this stage, we conducted case analysis and performed a small sample test. The second formal survey was conducted from June to September in 2016. At this stage, data were collected from subordinates and their supervisors from 121 knowledge worker teams (such as project team and R&D team) in 31 Chinese high-technology organizations located in the eastern part of China (67.74% in software and system integration; 19.35% in meters and equipment manufacturing; and 12.91% in biotechnology and pharmaceuticals), such as Shandong, Shanghai, Jiangsu, and Shenzhen. Chinese high-technology organizations were selected because employee creativity to develop newer services and products is emphasized in these organizations (Jia et al., 2014). Participation was voluntary, and respondents were assured of the anonymity of their responses. To avoid common method bias, we collected data with two separate questionnaires: one for the subordinates who assessed external knowledge search, internal knowledge sharing, absorptive capacity, knowledge integration, task interdependence, and task complexity, and the other for their supervisors, who assessed environmental dynamism and team creativity.

A total of 487 matched employee-supervisor questionnaires were returned (an 81.17 percent response rate). Because of missing data and some smaller teams (i.e. fewer than three members), the final sample used in the analyses comprised 377 employee-supervisor matched questionnaires and 110 teams.

6.2 Demographic descriptive statistics

Table 6.1 presents descriptive statistics at individual level. As shown in the table, 61.81% were male; their job tenure mainly focuses on 3-10 years (52.16%), and their age mainly focuses on 26-35 years (52.57%). In addition, 57.29% had bachelor's degrees, 27.93% had master's degrees, and 4.93% had PhDs.

Table 6.1 Descriptive statistics (Individual) (N=487)

Variables	Type	Samples	Percentage
Gender	Male	301	61.81%
	Female	186	38.19%
Age	25	84	17.25%
	25-35	256	52.57%
	36-45	108	22.18%
	45	39	8.01%
Education level	Junior colleague or below	48	9.86%
	Bachelor	279	57.29%
	Master	136	27.93%
	Doctor	24	4.93%
Tenure	3	136	27.93%
	3-10	254	52.16%
	11-20	76	15.61%
	Above 20	21	4.31%

Table 6.2 presents descriptive statistics at the team level. As shown in the table, team size is mainly focussing on 11-20 (about 50.91%), and the team tenure focuses mainly on above 5 years (about 51.82%).

Table 6.2 Descriptive statistics (Team) (N=110)

Variables	Type	Samples	Percentage
	Below 10	10	9.09%

Team size	11-20	56	50.91%
	Above 20	44	40.00%
	3	12	10.91%
Team age	3-5	41	37.27%
	5	57	51.82%
	Below 10	6	19.35%
Firm age	11-30	19	61.29%
	Above 30	6	19.35%
Firm size	Below 500	9	29.03%
	500-1000	9	29.03%
	Above 1000	13	41.94%

6.3 Level of analysis

In our study, all the hypotheses were at the team level, and we aggregated the individual-level variables to the team-level according to the composition theory (Rousseau, 1985). We assessed within-team agreement before aggregation by using R_{wg} (James, DeMaree & Wolf, 1984), ICC1 and ICC2 (Bliese, 2000). The average inter-rater agreement coefficients (R_{wg}) for the six variables of external knowledge search (.87, ranging from .74-.89), internal knowledge sharing (.81, ranging from .73-.84), absorptive capacity (.78, ranging from .77-.85), knowledge integration (.79, ranging from .78-.83), task interdependence (.72, ranging from .70-.76), and task complexity (.76, ranging from .73-.81) indicated high inter-rater agreement (above the value .70).

The intra-class correlation coefficient (ICC1) values were as follows: external knowledge search (.31), internal knowledge sharing (.27), absorptive capacity (.24), knowledge integration (.22), task interdependence (.27), and task complexity (.30). The test statistics (F-ratios) associated with the ICC1 values of all six variables were

statistically significant. The intra-class correlation coefficient ICC2 values were as follows: external knowledge search (.82), internal knowledge sharing (.77), absorptive capacity (.84), knowledge integration (.75), task interdependence (.81), and task complexity (.79). The ICC2 values of all six variables were higher than .50. Thus, we concluded that aggregation was justified for these six variables.

6.4 Reliability and construct validity

As shown in Table 6.4, the Cronbach α for all variables (such as external knowledge search, internal knowledge sharing, absorptive capacity, knowledge integration, task interdependence, task complexity, environment dynamism, team creativity) are above 0.70 (ranging from 0.727 to 0.899).

Also, we performed a confirmatory factor analysis using individual-level data to examine the construct distinctiveness of the eight major variables in our model. We tested a model that contained eight factors: Internal knowledge sharing, absorptive capacity, knowledge integration, external knowledge search, task complexity, task interdependence, environmental dynamism, and team creativity. Results showed the eight-factor model provided a good fit, with all fit indices within acceptable levels (χ^2=195.97, df=161, CFI=.96, RMSEA=.045, and TLI=.95). We further compared the eight-factor model to a one-factor model that consisted of one single factor (χ^2=723.28, df=189, CFI=.38, RMSEA=.161, and TLI=.31). A chi-square difference test showed the four-factor model exhibited a better fit than the one-factor model ($\chi^2_{difference}$=527.31, df =28, p< .01).

Table 6.3 Confirmatory factor analysis

Models	Factors	χ^2	df	RMSEA	CFI	TLI
M1	EKS；KS；AC；KI；TC；ED；TI; TCom	195.97	161	0.045	0.96	0.95
M2	EKS+KS；AC；KI；TC；ED; TI; TCom	242.34	168	0.064	0.91	0.89
M3	EKS+KS+AC；KI；TC；ED; TI; TCom	253.94	174	0.065	0.91	0.88
M4	EKS+KS+AC+KI；TC；ED; TI; TCom	325.83	179	0.087	0.83	0.80

M5	EKS+KS+AC+KI+TC；ED; TI; TCom	390.85	183	0.102	0.76	0.72
M6	EKS+KS+AC+KI+TC+ED; TI; TCom	576.26	186	0.139	0.55	0.49
M7	EKS+KS+AC+KI+TC+ED+TI; TCom	660.44	188	0.152	0.45	0.38
M8	EKS+KS+AC+KI+TC+ED+TI+TCom	723.28	189	0.161	0.38	0.31

Note：EKS=External knowledge search；KS=Knowledge sharing；AC=Absorptive capacity；KI=knowledge integration；TC=Team creativity; ED=Environmental dynamism；TI=Task interdependence；TCom=Task complexity

6.5 Research model and hypotheses test

6.5.1 Descriptive statistics and correlation analysis

As shown in Table 6.3, external knowledge search is positively related to absorptive capacity, knowledge integration, team creativity, and environmental dynamism ($r = 0.540$, $p < 0.01$; $r = 0.349$, $p < 0.01$; $r = 0.283$, $p < 0.01$; $r = 0.267$, $P < 0.01$). Internal knowledge sharing is positively related to absorptive capacity, knowledge integration, and team creativity ($r=0.637$, $p<0.01$； $r=0.278$, $p<0.01$; $r=0.433$, $p<0.01$). Absorptive capacity and knowledge integration are positively related to team creativity ($r = 0.445$, $P < 0.01$; $r = 0.339$, $P < 0.01$). In addition, task interdependence and task complexity are positively related to team creativity ($r = 0.197$, $P < 0.01$; $r = 0.134$, $P < 0.05$).

Table 6.4 Means, standard deviations, and correlations among study variables

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
Male percentage	0.639	0.540	**NA**												
Team age	2.409	0.681	0.107	**NA**											
Team size	2.310	0.632	0.026	-0.018	**NA**										
Firm age	2.000	0.063	-0.076	-0.073	-0.034	**NA**									
Firm size	2.129	0.819	-0.069	-0.120	0.057	0.192**	**NA**								
Knowledge search	2.912	0.487	-0.103	-0.064	-0.034	0.036	-0.043	**0.763**							
Knowledge sharing	3.589	0.627	-0.109	-0.078	0.122	0.025	0.023	0.462**	**0.727**						
Absorptive capacity	3.306	0.649	-0.069	-0.008	0.011	-0.027	-0.048	0.540**	0.637**	**0.892**					
Knowledge integration	3.727	0.735	-0.111	-0.010	-0.050	0.001	-0.041	0.349**	0.278**	0.373**	**0.879**				
Team creativity	3.589	0.682	-0.074	-0.019	0.123	0.092	0.001	0.283**	0.433**	0.445**	0.339**	**0.853**			
Environmental dynamism	3.342	0.574	0.102	0.067	0.033	0.067	0.032	0.267**	-0.021	0.022	0.001	0.209**	**0.899**		
Task interdependence	3.941	0.625	-0.105	0.031	0.069	0.114	0.040	0.043	0.316**	0.204**	0.016	0.197**	0.013	**0.855**	
Task complexity	3.639	0.725	0.028	0.019	-.131*	0.083	0.087	-0.044	0.088	0.002	0.108	0.134*	0.087	0.152**	**0.789**

*P＜0.050, **P＜0.010

6.5.2 Graphical depiction of the mediating effects of absorptive capacity

The results of the regression analyses for the mediating roles of absorptive capacity and knowledge integration in the relationship between external knowledge search and team creativity are presented in Table 6.5. The results also showed support for H3 and H5 (The mediating roles of absorptive capacity and knowledge integration in the relationship between external knowledge search and team creativity). We ran tests following the procedure recommended by Baron and Kenny (1986). First, external knowledge search was found to be positively related to absorptive capacity and knowledge integration (M10, r= 0.35, $p < 0.01$; M12, r= 0.43, $p < 0.01$). Second, external knowledge search was positively related to team creativity (M16: r=.28 $p<0.01$). Third, absorptive capacity and knowledge integration were positively related to team creativity (M17, r= 0.44, $p < 0.01$; M18, r= 0.34, $p < 0.01$). Finally, the significant coefficient of external knowledge search for team creativity was no longer significant after adding absorptive capacity and knowledge integration (M19: β=0.02, n.s.). In addition, absorptive capacity is positively related to knowledge integration (M13, r= 0.37, $p < 0.01$), and the significant coefficient of external knowledge search for knowledge integration was less positive after adding absorptive capacity (M14: β=0.20, $p < 0.01$). This indicates that absorptive capacity and knowledge integration fully mediated the relationship between external knowledge search and team creativity, and absorptive capacity partially mediated the relationship between external knowledge search and knowledge integration.

Table 6.5 Regression results (Independent variable =External knowledge search)

	Absorptive capacity		Knowledge integration				Team creativity				
Variables	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19
Control variables											
Male percentage	-0.07	0.04	-0.11	-0.05	-0.09	-0.06	-0.08	-0.02	-0.05	-0.04	-0.02
Team age	0.00	0.02	0.03	0.04	0.03	0.03	-0.01	0.01	-0.01	-0.01	-0.01
Team size	0.01	0.03	-0.05	-0.04	-0.05	-0.04	0.13	0.13	0.12	0.13	0.13

Independent variable											
Knowledge search		0.35**		0.43**		0.20**		0.28**			0.02
Mediator											
Absorptive capacity					0.37**	0.27**			0.44**		0.34**
Knowledge integration										0.34**	0.20**
△F	0.18	43.08	0.55	13.35	16.66	6.26	0.76	8.99	25.82	14.02	10.48
R^2	0.01	0.29	0.02	0.13	0.15	0.18	0.02	0.10	0.21	0.14	0.25
$\triangle R^2$	0.01	0.29	0.02	0.11	0.14	0.05	0.02	0.08	0.19	0.12	0.15

*P＜0.05；**P＜0.01；

In addition, the results of the regression analyses for the mediating role of absorptive capacity and knowledge integration in the relationship between internal knowledge sharing and team creativity are presented in Table 6.6. The results also showed support for H4 and H6 (The mediating roles of absorptive capacity and knowledge integration in the relationship between internal knowledge sharing and team creativity). We ran tests following the procedure recommended by Baron and Kenny (1986). First, internal knowledge sharing was found to be positively related to absorptive capacity and knowledge integration (M21, r=0.26, $p < 0.01$; M23, r= 0.28, $p < 0.01$). Second, internal knowledge sharing was positively related to team creativity (M27, r= 0.43, $p < 0.01$). Third, absorptive capacity and knowledge integration were positively related to team creativity (M28, r= 0.44, $p < 0.01$; M29, r= 0.34, $p < 0.01$). Finally, the significant coefficient of internal knowledge sharing for team creativity was no longer significant after adding absorptive capacity and knowledge integration (M30: r=0.12, n.s.). In addition, absorptive capacity is positively related to knowledge integration (M13, r= 0.37, $p < 0.01$), and the significant coefficient of internal knowledge sharing for knowledge integration was less positive after adding absorptive capacity (M14: β=0.16, $p < 0.05$). This indicates that absorptive capacity and knowledge integration completely mediated the relationship between internal knowledge sharing and team creativity, and absorptive capacity partially mediated the relationship between internal knowledge sharing and knowledge integration.

Table 6.6 Regression results (Independent variable =Internal knowledge sharing)

	Absorptive capacity		Knowledge integration				Team creativity				
Variables	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
Control variables											
Male percentage	-0.07	0.07	-0.11	-0.06	-0.09	-0.08	-0.08	-0.01	-0.05	-0.04	0.01
Team age	0.00	0.03	0.03	0.04	0.03	0.03	-0.01	0.01	-0.01	-0.01	-0.00
Team size	0.01	-0.07	-0.05	-0.08	-0.05	-0.06	0.13	0.07	0.12	0.13	0.10
Independent variable											
Knowledge sharing		0.26**		0.28**		0.16*		0.43**			0.12
Mediator											
Absorptive capacity					0.37**	0.33**			0.44**		0.23**
Knowledge integration										0.34**	0.20**
△F	0.18	73.77	0.55	8.42	16.66	7.82	0.76	22.29	25.82	14.02	6.02
R^2	0.01	0.42	0.02	0.09	0.15	0.15	0.02	0.19	0.21	0.14	0.28
$\triangle R^2$	0.01	0.41	0.02	0.07	0.14	0.13	0.02	0.17	0.19	0.12	0.09

*P＜0.05；**P＜0.01；

6.5.3 Graphical depiction of the mediating effects of knowledge integration

We performed a confirmatory factor analysis using AMOS 17.0 to examine the relationship between knowledge acquisition (external knowledge search and internal knowledge sharing) and team creativity, and the mediating roles of absorptive capacity and knowledge integration. The standardized path coefficients for the hypothesized mediation are presented in Figure 1. All the hypothesized paths are significant. External knowledge search has a significantly positive relationship with team creativity through absorptive capacity (r=0.48, p<0.01) and knowledge integration (r= 0.55, p<0.01). Absorptive capacity (r= 0.33, p<0.05) and knowledge integration (r= 0.29, p<.05) have positive relationships with team creativity. Also,

internal knowledge sharing has a significantly positive relationship with team creativity through absorptive capacity (r=0.68, p<0.01) and knowledge integration (r= 0.31, p<0.01). In addition, absorptive capacity is positively related to knowledge integration (r=0.33, p<0.01). All hypotheses are supported.

The fit indices for the hypothesized model were (χ^2=45.30, df=35, CFI=.97, RMSEA=.052, and TLI=.96). The alternative model (adding direct paths from abusive supervision to team creativity) did not have a better fit based on the non-significance of the Chi square change ($\Delta\chi^2$ (2) = 2.58, n.s.). As a result, the hypothesized mediation model was showed to be the best model.

Table 6.7 Structural equation

Model	χ^2	df	RMSEA	CFI	TLI
M9 EKS-TC；EKS-KI-TC；EKS-AC-TC；AC-KI ；KS-TC；KS-KI-TC；KS-AC-TC；	45.30	35	0.052	0.97	0.96
M10 EKS-KI-TC；EKS-AC-TC；AC-KI；KS-KI-TC；KS-AC-TC；	47.88	37	0.052	0.98	0.96

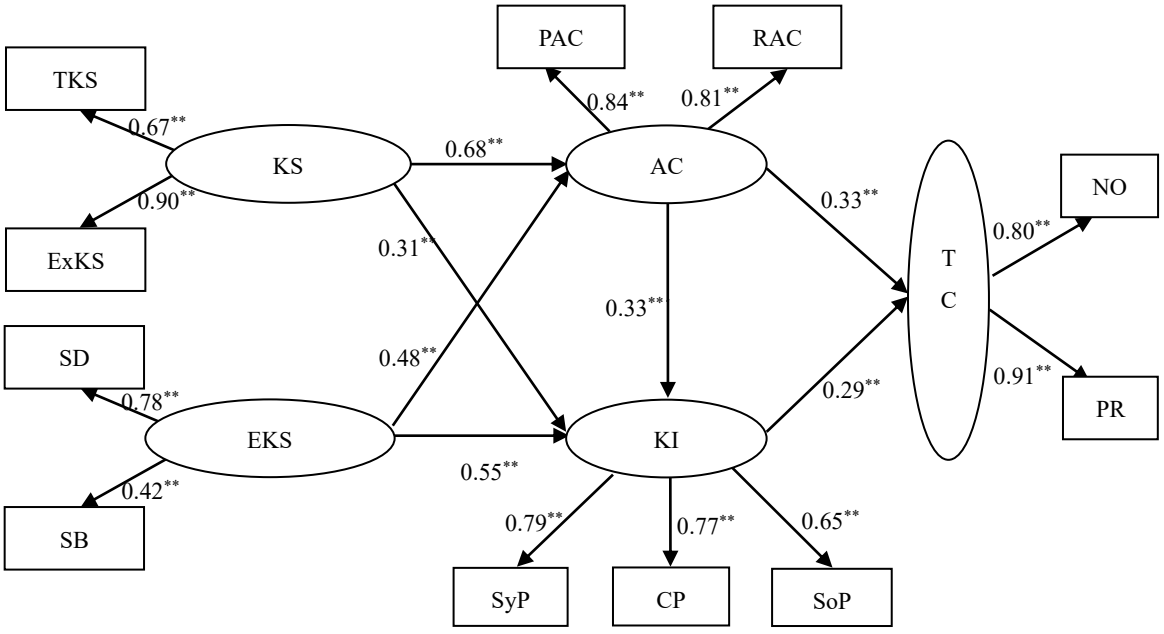


Figure 6.1 Standardized path loadings of the impacts of external knowledge search and internal knowledge sharing on team creativity

Note：TKS=Tacit knowledge sharing；ExKS=Explicit knowledge sharing；SD=Search depth；SB=Search breadth；KI=knowledge integration；PAC=Potential absorptive capacity；RAC=Realized absorptive capacity；TC=Team creativity；SyP=System process；CP=cooperative process；SoP=Socialization process；NO=Novel；PR=Practiceful；
*P＜0.05；**P＜0.01；

6.5.4 Graphical depiction and simple slopes of the moderating effects

In order to test the moderating effects, we conducted a four-step hierarchical moderated multiple regression analysis (Aiken & West, 1991). The control variables (i.e. educational level, gender, and job tenure) were entered first, followed by the independent variable in the second step. The hypothesized moderating variables were entered in the third step. In the fourth step, the interaction terms were entered in the model. In order to reduce multicollinearity, the variables used in the interaction terms were centered (Aiken & West, 1991).

More specifically, HLM was used to test the moderating role of environmental dynamism in the relationship between external knowledge search (as well as internal knowledge sharing) and absorptive capacity (as well as knowledge integration). Table 6.8 presents the results of this analysis.

(1) Zero-models test

Zero models are used to examine whether we should conduct multi-level analysis. A zero model (absorptive capacity as the dependent variables) is established as follows.

M0 (Absorptive capacity) ：

L1： Absorptive capacity = $\beta_0 + \gamma$

L2： $\beta_0 = \gamma_{00} + \mu_0$

In M0, $\rho=\tau_{00}/ (\tau_{00}+\sigma^2)$ =0.183/ (0.183+0.470) =0.280. More specifically, the variation of absorptive capacity caused by organizational-level factors accounts for 28%. That is, the variation of absorptive capacity is caused by both team-level factors and organizational-level factors. Thus, data can be conducted multi-level analysis.

M0 (Knowledge integration) ：

L1： Knowledge integration = $\beta_0 + \gamma$

L2： $\beta_0 = \gamma_{00} + \mu_0$

In M0, $\rho=\tau00/(\tau00+\sigma2)$ = 0.199 / (0.199 + 0.509) = 0.281. More specifically, the variation of knowledge integration caused by organizational-level factors accounts for 28.1%, namely, the variation of knowledge integration is caused by both team-level factors and organizational-level factors. Thus, data can be conducted multi-level analysis.

(2) The effects of external knowledge search on absorptive capacity (knowledge integration)

At this stage, we mainly examine the effects of external knowledge search and control variables (e.g., firm size, firm age, team gender percentage, and team size) on absorptive capacity (In model 2 and 6).

M2：

Level-1：Absorptive capacity=β_0+β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$；

M6：

Level-1：Knowledge integration=β_0+β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$；

As shown in Table 6.8, in Models 2 and 6, external knowledge search is positively related to absorptive capacity and knowledge integration ($r=0.36$, $p<0.01$; $r=0.48$ $p<0.01$)

(3) The interactive effects of external knowledge search and environmental dynamism on absorptive capacity.

At this stage, we mainly examine the effects of external knowledge search, environmental dynamism, and control variables (e.g., firm size, firm age, male percentage, and team size) on absorptive capacity (model 3 and model 7).

M3：

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

M7：

Level-1：Knowledge integration=β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Results showed that the coefficients for absorptive capacity and knowledge integration are more significant after adding external knowledge search and environmental dynamism (Pseudo$\triangle R^2$=0.333, p<0.01; Pseudo$\triangle R^2$=0.391, p<0.01).

(4) The interactive effects of external knowledge search and environmental dynamism on absorptive capacity and knowledge integration

At this stage, we mainly examine the effects of external knowledge search, environmental dynamism, control variables (e.g., firm size, firm age, team gender percentage, and team size), and the interactive effects of external knowledge search and environmental dynamism on absorptive capacity and knowledge integration (model 4 and model 8).

M4：

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (external knowledge search×environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

M8：

Level-1：Knowledge integration=β0 +β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β4 (external knowledge search) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (external knowledge search×environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

To test Hypotheses 8 and 9, a set of multilevel models were established based on theoretical predictions by using the incremental improvement procedure (Hox, 2010). Table 6.8 summarizes the interaction effects of external knowledge search and environmental dynamism on absorptive capacity and knowledge integration. Results showed that the interaction between external knowledge search and environmental dynamism is positively related to absorptive capacity and knowledge integration (r=0.30, p<0.01； r=0.24; p<0.01). We plotted the interaction effects using Stone and Hollenbeck's (1989) procedure. Figure 6.2 demonstrates that external knowledge search is more positively related to absorptive capacity when environmental dynamism is high (r=0.66, p<0.01) rather than low (r=0.06, n.s.). Simultaneously, Figure 6.3 presents that external knowledge search is more positively related to

knowledge integration when environmental dynamism is high (r=0.72, p<0.01) rather than low (r=0.24, p<0.01). Hence, Hypotheses 8 and 9 were supported.

Table 6.8 The moderating role of environmental dynamism (Knowledge search)

		Absorptive capacity				Knowledge integration			
		M1	M2	M3	M4	M5	M6	M7	M8
Intercept		3.76**	3.76**	3.76**	3.77**	3.80**	3.80**	3.79**	3.79**
Team level	Male percentage	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Team age	0.08	0.08	0.08	0.08	0.16*	0.16*	0.16*	0.16*
	Team size	-0.10	-0.10	-0.10	-0.10	-0.03	0.02	-0.03	-0.03
Organizational level	Firm age	-0.03	-0.08	-0.02	-0.00	-0.06	-0.13	-0.09	-0.07
	Firm size	0.03	0.00	--0.08	0.15*	0.01	-0.03	-0.09	0.11
Independent variable	Knowledge search		0.36**	0.41**	0.19**		0.48**	0.50**	0.32**
Moderator	Environmental dynamism			-0.21**	0.10			-0.15*	0.11
Interactive effect	Knowledge search× Environmental dynamism				0.30**				0.24**
Variance component	Sigma_square	0.48	0.48	0.48	0.48	0.51	0.51	0.51	0.51
Estimation	Tau	0.21	0.15	0.14	0.08	0.23	0.14	0.14	0.11
Team level	Pseudo R^2 change	----	0	0	0	----	0	0	0
Organizational level	Pseudo R^2 change	----	28.57 %	33.33%	61.90%	----	39.13%	39.13%	52.17%

*P＜0.05；**P＜0.01；

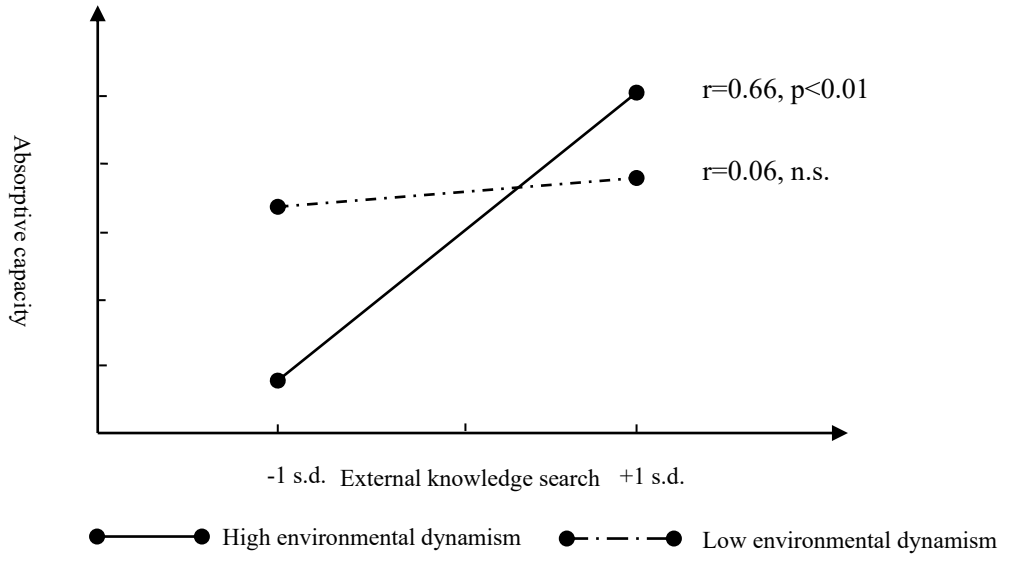


Figure 5.2 Interactive effects of external knowledge search and environmental dynamism on absorptive capacity

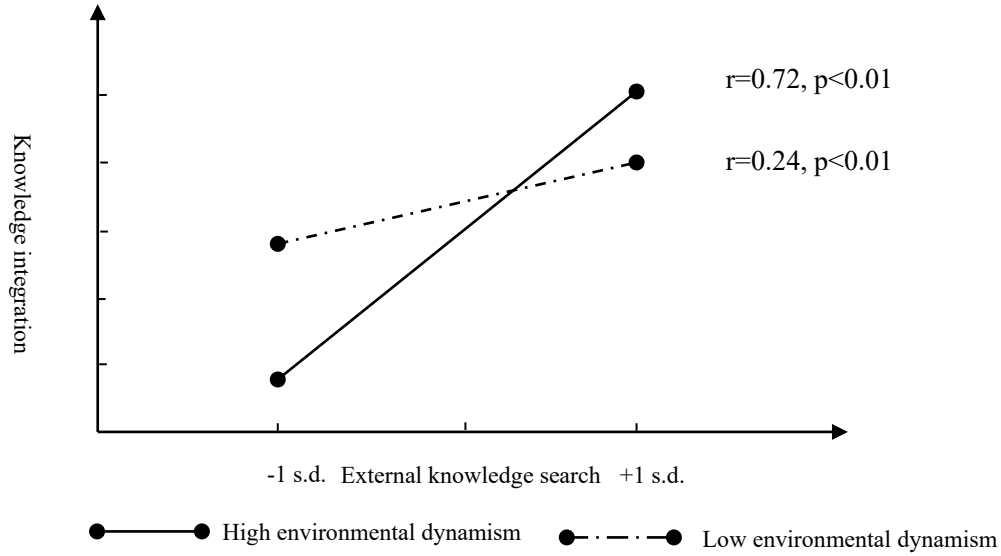


Figure 6.3 Interactive effects of external knowledge search and environmental dynamism on knowledge integration

At the same time, HLM was used to test the moderating role of environmental dynamism in the relationship between internal knowledge sharing and absorptive capacity (as well as knowledge integration). Table 6.9 presents the results of this analysis.

(1) Zero-models test

Zero models are used to examine whether we should conduct multi-level analysis. A zero model (absorptive capacity as the dependent variables) is established as follows.

M0 (Absorptive capacity) ：

L1：Absorptive capacity = $\beta_0 + \gamma$

L2：$\beta_0 = \gamma_{00} + \mu_0$

In M0, $\rho=\tau00/ (\tau00+\sigma2)$ =0.183/ (0.183+0.470) =0.280. More specifically, the variation of absorptive capacity caused by organizational-level factors accounts for 28%. That is, the variation of absorptive capacity is caused by both team-level factors and organizational-level factors. Thus, data can be conducted multi-level analysis.

Also, a zero model (knowledge integration as the dependent variables) is established.

M0 (Knowledge integration) ：

L1：Knowledge integration = $\beta_0 + \gamma$

L2：$\beta_0 = \gamma_{00} + \mu_0$

In M0, $\rho=\tau00/ (\tau00+\sigma2)$ =0.199/ (0.199+0.509) =0.281. More specifically, the

variation of knowledge integration caused by organizational-level factors accounts for 28.1%, namely, the variation of knowledge integration is caused by both team-level factors and organizational-level factors. Thus, data can be conducted multi-level analysis.

(2) The effect of internal knowledge sharing on absorptive capacity (knowledge integration)

At this stage, we mainly examine the effects of internal knowledge sharing and control variables (e.g., firm size, firm age, male percentage, and team size) on absorptive capacity (In Models 10 and 14).

M10：

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β_4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$

Level-1：Absorptive capacity=β_0+β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$；

M14：

Level-1：Knowledge integration=β0 +β1 (male percentage) +β2 (team age) +β3 (Team size) +β4 (Internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Level-1：Knowledge integration=β_0+β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$；

As shown in Table 6.9, in Models 10 and 14, internal knowledge sharing is positively related to absorptive capacity and knowledge integration ($r=0.22$, $p<0.01$; $r=0.23$ $p<0.01$)

(3) The interactive effects of internal knowledge sharing and environmental dynamism on absorptive capacity.

At this stage, we mainly examine the effects of internal knowledge sharing, environmental dynamism, and control variables (e.g., firm size, firm age, team gender

percentage, and team size) on absorptive capacity (In Models 11 and 15).

M11：

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β_4 (Internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (Environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

M15：

Level-1：Knowledge integration=β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Results show that the coefficients for absorptive capacity and knowledge integration are not significant after adding internal knowledge sharing and environmental dynamism (Pseudo△R2=-0.048, p>0.050； Pseudo△R2=-0.044, p>0.050)

Level-1：Knowledge integration=β0 + β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β_4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

(4) The interactive effects of internal knowledge sharing and environmental dynamism on absorptive capacity and knowledge integration

At this stage, we mainly examine the effects of internal knowledge sharing, environmental dynamism, control variables (e.g., firm size, firm age, team gender percentage, and team size), and the interactive effects of internal knowledge sharing and environmental dynamism on absorptive capacity and knowledge integration (In Models 4 and 8).

M12：

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (internal knowledge sharing×environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Level-1：Absorptive capacity=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β_4 (internal knowledge sharing) +γ

Level-2：β0=γ_{00} +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (environmental dynamism×internal knowledge sharing) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

M16：

Level-1：Knowledge integration=β0 +β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team scale) +β4 (internal knowledge sharing) +γ

Level-2：$\beta_0=\gamma_{00}$ +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (internal knowledge sharing×environmental dynamism) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

Level-1：Knowledge integration=β_0 +β_1 (male percentage) +β_2 (team age) +β_3 (team size) +β_4 (internal knowledge sharing) +γ

Level-2：β0=γ_{00} +γ_{01} (firm age) +γ_{02} (firm size) +γ_{03} (environmental dynamism) +γ_{04} (environmental dynamism×internal knowledge sharing) +μ_0

$\beta_1 = \gamma_{10} + \mu_1$； $\beta_2 = \gamma_{20} + \mu_2$； $\beta_3 = \gamma_{30} + \mu_3$； $\beta_4 = \gamma_{40} + \mu_4$

To test Hypotheses 10 and 11, a set of multilevel models were developed based on theoretical predictions by using the incremental improvement procedure (Hox,

2010). Table 6.9 shows the interactive effects of internal knowledge sharing and environmental dynamism on absorptive capacity and knowledge integration. Results showed that the interaction between internal knowledge sharing and environmental dynamism is not significantly related to absorptive capacity and knowledge integration (r=0.11, n.s.; r=0.03, n.s.). Hence, Hypotheses 10 and 11 were not supported.

Table 6.9 The moderating role of environmental dynamism (Internal knowledge sharing)

		Absorptive capacity				Knowledge integration			
		M9	M10	M11	M12	M13	M14	M15	M16
Intercept		3.77**	3.76**	3.75**	3.76**	3.80**	3.79**	3.79**	3.79**
Team level	Male percentage	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Control variables	Team age	0.08	0.08	0.08	0.08	0.16*	0.16*	0.16*	0.16*
	Team size	-0.10	-0.10	-0.10	-0.10	-0.03	-0.03	-0.03	-0.03
Organizational level Control variables	Firm age	-0.03	-0.08	-0.04	-0.02	-0.06	-0.11	-0.11	-0.10
	Firm size	0.03	0.00	-0.03	-0.02	0.01	-0.02	-0.02	-0.02
Independent variable	Knowledge sharing		0.22**	0.22**	0.21**		0.23**	0.24**	0.23**
Moderator	Environmental dynamism			-0.11	-0.08			-0.01	-0.00
Interactive effect	Internal knowledge sharing× Environmental dynamism				0.11				0.03
variance component	Sigma_square	0.47	0.47	0.46	0.46	0.50	0.50	0.50	0.50
Estimation	Tau	0.21	0.21	0.22	0.23	0.23	0.22	0.24	0.25
Team level	Pseudo R^2 change	----	0	2.17%	2.17%	----	0	0	0
Organizational level	Pseudo R^2 change	----	0.00%	-4.76%	-9.52%	----	4.35%	-4.35%	-8.70%

*P＜0.05；**P＜0.01；

In addition, we examined the interactive effects of external knowledge search and internal knowledge sharing on team creativity. To test the moderating effects, we conducted a four-step hierarchical moderated multiple regression analysis (Aiken & West, 1991). The control variables were entered first, followed by the independent variable (i.e. external knowledge search) in the second step. The hypothesized moderating variable (i.e. internal knowledge sharing) was entered in the third step. In the fourth step, the interaction terms were entered in the model successively. In order

to reduce multicollinearity, the variables used in the interaction terms were centered (Aiken & West, 1991). Results showed that the interaction between external knowledge search and internal knowledge sharing was positively related to absorptive capacity (r=0.15, p<0.01, Model 20); the interaction between external knowledge search and internal knowledge sharing was positively related to knowledge integration (r=0.14, p<0.05, Model 24). We plotted the interaction effects using Stone and Hollenbeck's (1989) procedure. Figure 2 shows that external knowledge is more positively related to absorptive capacity when internal knowledge sharing is high (r=0.70, p<0.01) rather than low (r=0.40, p<0.01). Also, external knowledge is more positively related to knowledge integration when internal knowledge sharing is high (r=0.48, p<0.01) rather than low (r=0.20, p<0.01). Hence, Hypotheses 12 and 13 were supported.

Table 6.10 Regression results for testing the moderating role of internal knowledge sharing

Variables	Absorptive capacity				Knowledge integration			
	M17	M18	M19	M20	M21	M22	M23	M24
Control variables								
Male percentage	-0.07	0.04	0.10	0.08	-0.11	-0.05	-.0.03	-0.05
Team age	0.00	0.02	0.04	0.06	0.03	0.04	0.04	0.06
Team size	0.01	0.03	-0.04	-0.05	-0.05	-0.03	-0.06	-0.06
Step 2 主效应								
Knowledge search		0.55**	0.32**	0.31**		0.34**	0.27**	0.27**
Internal knowledge sharing			0.52**	0.54**			0.16*	0.18*
Step 3Interactive effect								
Knowledge search× Internal knowledge sharing				0.15*				0.14*

△F	0.18	43.07	41.37	3.8	0.55	13.34	2.26	1.96
R^2	0.01	0.29	0.50	0.51	0.02	0.13	0.15	0.16
$\triangle R^2$	0.01	0.28	0.21	0.02	0.02	0.11	0.02	0.02

*P＜0.05；**P＜0.01；

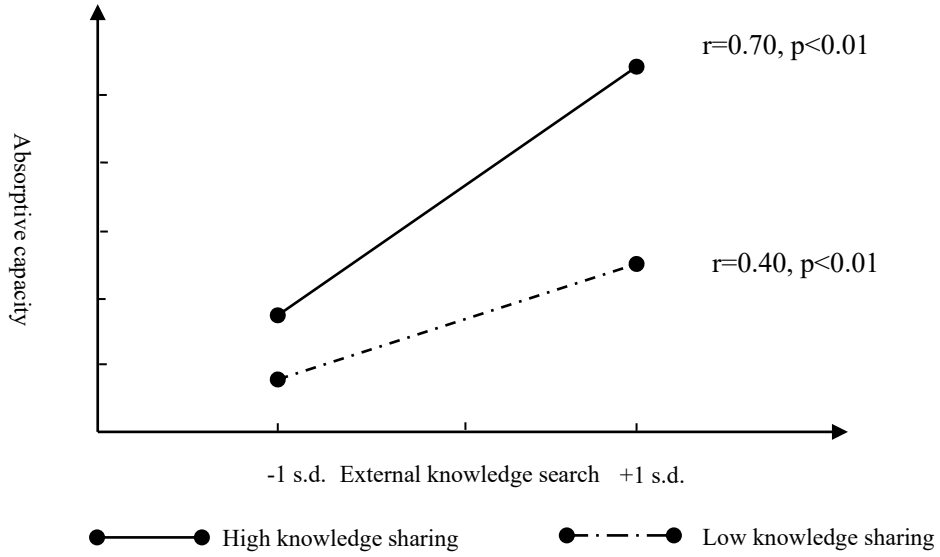


Figure 6.4 Interactive effects of external knowledge search and internal knoweldge sharing on absorptive capacity

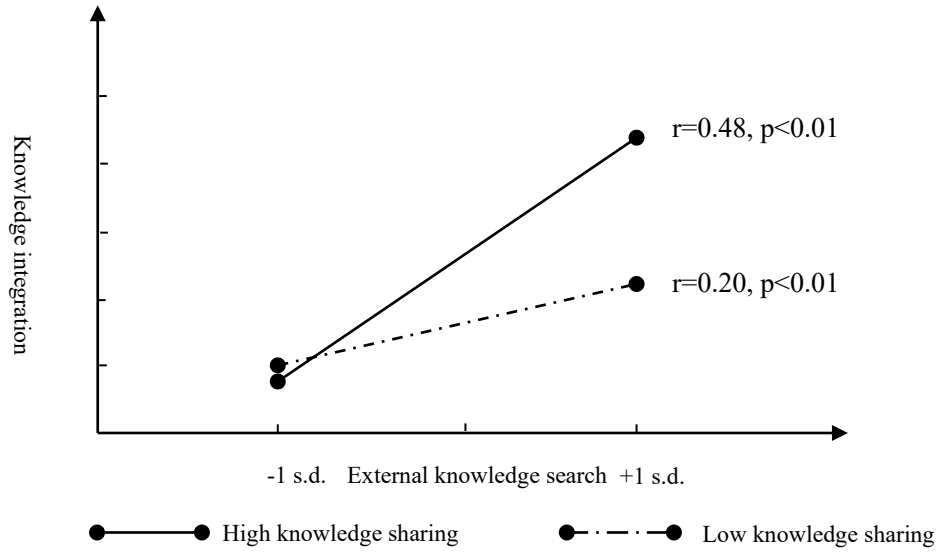


Figure 6.5 Interactive effects of external knowledge search and internal knowledge sharing on knowledge integration

In addition, we examined the three-way interactive effect among absorptive

capacity, task interdependence, and task complexity on team creativity. To test the moderating effects, we conducted a five-step hierarchical moderated multiple regression analysis (Aiken & West, 1991). The control variables were entered first, followed by the independent variable (i.e. absorptive capacity and knowledge integration) in the second step. The hypothesized moderating variables (i.e. task interdependence and task complexity) were entered in the third step. In the fourth and fifth steps, three two-way and one three-way interaction terms were entered in the model successively. In order to reduce multicollinearity, the variables used in the interaction terms were centered (Aiken & West, 1991). Table 6.11 presents the results.

The results showed a significant positive interaction between absorptive capacity and task interdependence on team creativity ($r=0.17$, $p<0.05$) in model 28. Also, the results showed a significant positive interaction between absorptive capacity and task complexity on team creativity ($\gamma=0.19$, $p<0.01$). In addition, the interaction among absorptive capacity, task interdependence, and task complexity was positively related to team creativity ($r=0.16$, $p<0.05$, Model 29). To further explore the moderating effect, we conducted simple slope tests using the values of +1 and -1 standard deviations from the mean, As shown in Figures 6.6 and 6.7, absorptive capacity was more positively related to team creativity ($r=0.44$, $p<0.01$) when task interdependence was high. Absorptive capacity was more positively related to team creativity ($r=0.46$, $p<0.01$) when task complexity was high. Absorptive capacity was not significantly related to team creativity ($r=0.10$, n.s.; $r=0.08$, n.s.) when both task interdependence and task complexity were low. As shown in Figure 6.8, absorptive capacity was most positively related to team creativity ($r=0.71$, $p<0.01$) when both task interdependence and task complexity were high.

Table 6.11 Results of regression analyses on the moderating effects of task interdependence and task complexity (Absorptive capacity)

Variable	Team creativity				
	M25	M26	M27	M28	M29
Step 1 (Control variables)					
Male percentage	-0.08	-0.04	-0.04	-0.03	-0.07
Team age	-0.01	-0.01	-0.01	-0.02	-0.02
Team size	0.12	0.12	0.13*	0.12	0.12
Step 2					
Absorptive capacity		0.27**	0.26**	0.15*	0.14*
Task interdependence			0.08	0.08	0.09
Task complexity			0.14*	0.15*	0.11
step 3 Interactive effect					
Absorptive capacity×task interdependence				0.17*	0.12
Absorptive capacity×task complexity				0.19**	0.15*
Task interdependence×task complexity				0.03	0.04
step 3 Interactive effect					
Absorptive capacity×task interdependence×task complexity					0.16*
△F	0.76	25.82	1.92	0.77	4.51
R^2	0.02	0.21	0.24	0.26	0.29
$\triangle R^2$	0.02	0.19	0.03	0.02	0.03

*P＜0.05；**P＜0.01；

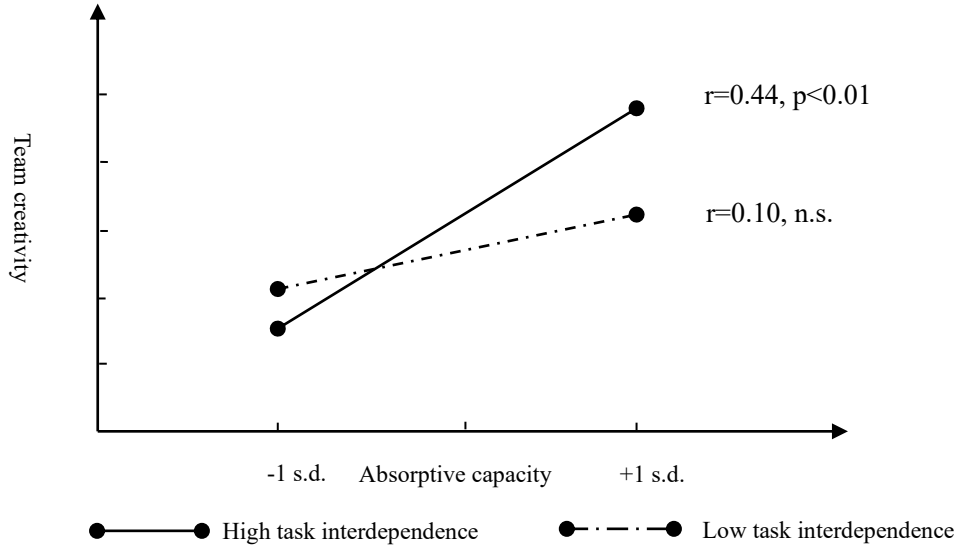


Figure 6.6 Interactive effects of absorptive capacity and task interdependence on team creativity

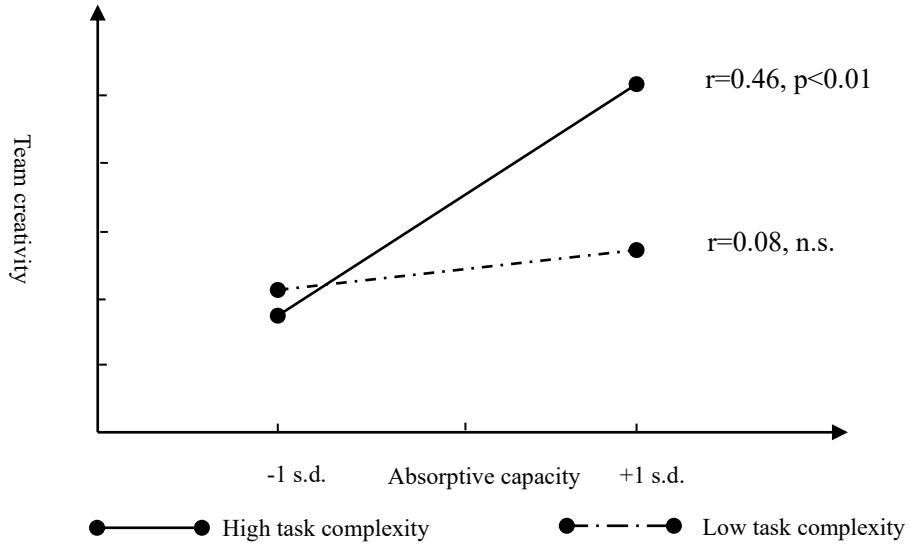


Figure 6.7 Interactive effects of absorptive capacity and task complexity on team creativity

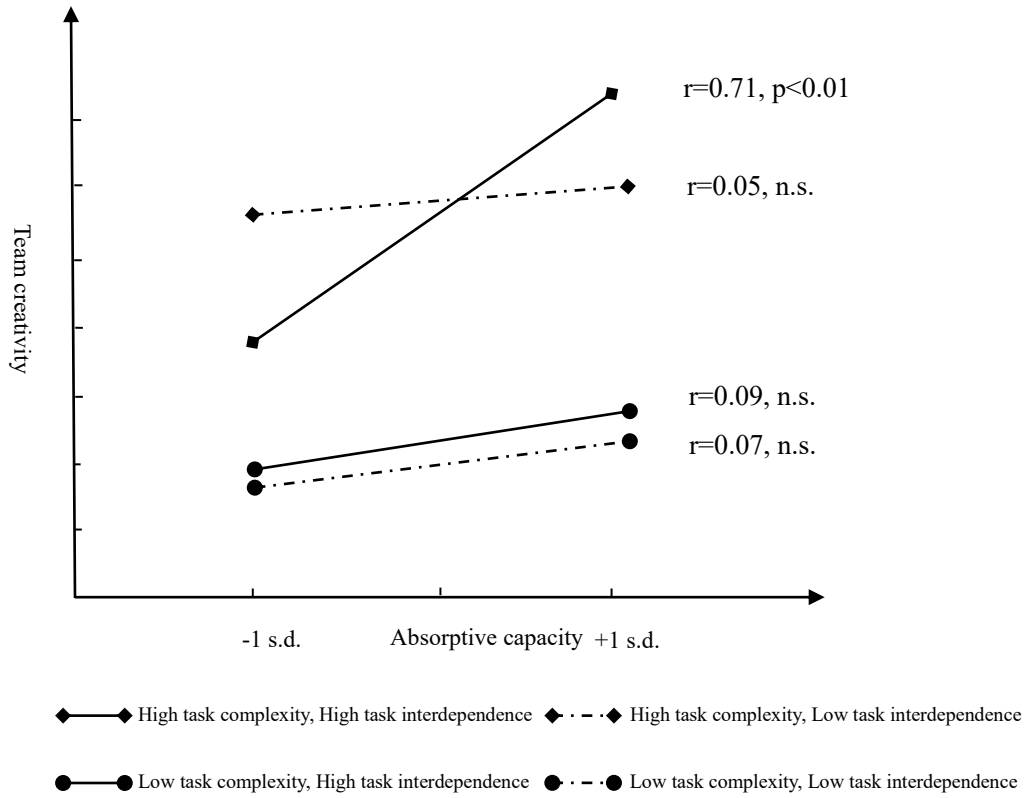


Figure 6.8 Interactive effects of absorptive capacity and task complexity and task interdependence on team creativity.

The results showed a significant positive interaction between knowledge integration and task interdependence on team creativity (r=0.21, p<0.01) in Model 33. Also, the results showed a significant positive interaction between knowledge integration and task complexity on team creativity (r=0.16, p<0.05, Model 33). In addition, the interaction among knowledge integration, task interdependence, and task complexity was positively related to team creativity (r=0.19, p<0.01, Model 34). Thus, H15, H17, and H19 were supported.

To further explore the moderating effect, we conducted simple slope tests using the values of +1 and -1 standard deviations from the mean, As shown in Figures 6.9 and 6.10, Knowledge integration was more positively related to team creativity (r=0.45, p<0.01) when task interdependence was high；Knowledge integration was more positively related to team creativity (r=0.40, p<0.01) when task complexity was high; Knowledge integration was not significantly related to team creativity (r=0.03, n.s.; r=0.08, n.s.) when both task interdependence and task complexity were low. As

shown in Figure 6.11, knowledge integration was most positively related to team creativity (r=0.80, p<0.01), when both task interdependence and task complexity were high.

Table 6.12 Results of regression analyses on the moderating effects of task interdependence and task complexity (Knowledge integration)

Variables	Team creativity				
	M30	M31	M32	M33	M34
Step 1(Control variables)					
Male percentage	-0.08	-0.04	-0.02	-0.01	-0.02
Team age	-0.01	-0.01	-0.02	-0.03	-0.02
Team size	0.12	0.14*	0.14*	0.15*	0.14*
Step 2					
Knowledge integration		0.24**	0.23**	0.12	0.11
task interdependence			0.17*	0.16*	0.15*
task complexity			0.09	0.10	0.08
step 3 Interactive effect					
Knowledge integration×task interdependence				0.21**	0.14*
Knowledge integration×task complexity				0.16*	0.13*
Task interdependence×task complexity				-0.02	0.03
step 3 Interactive effect					
Knowledge integration×task interdependence×task complexity					0.19**
△F	0.76	14.02	2.53	0.17	4.32
R^2	0.02	0.14	0.17	0.18	0.22
$\triangle R^2$	0.02	0.12	0.04	0.01	0.03

*P＜0.05；**P＜0.01；

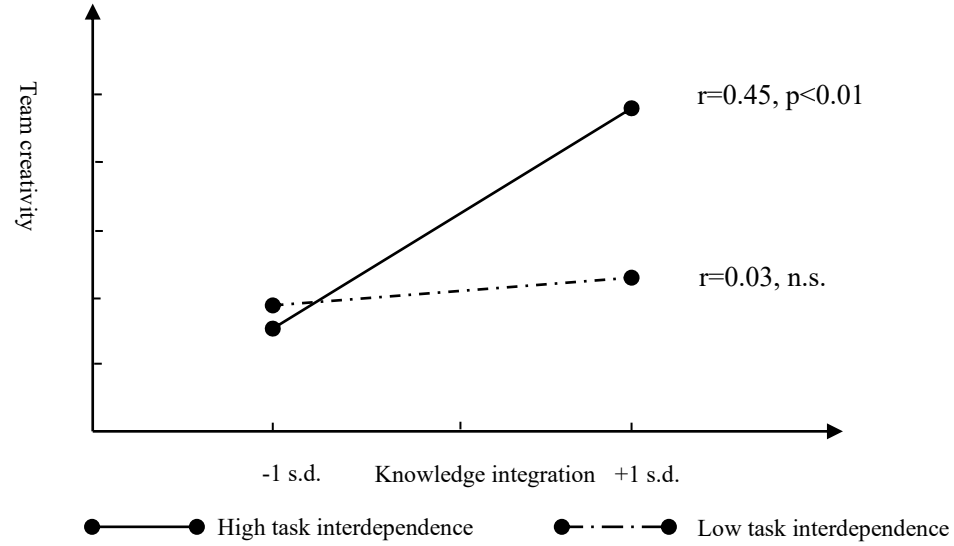


Figure 6.9 Interactive effects of knowledge integration and task interdependence on team creativity

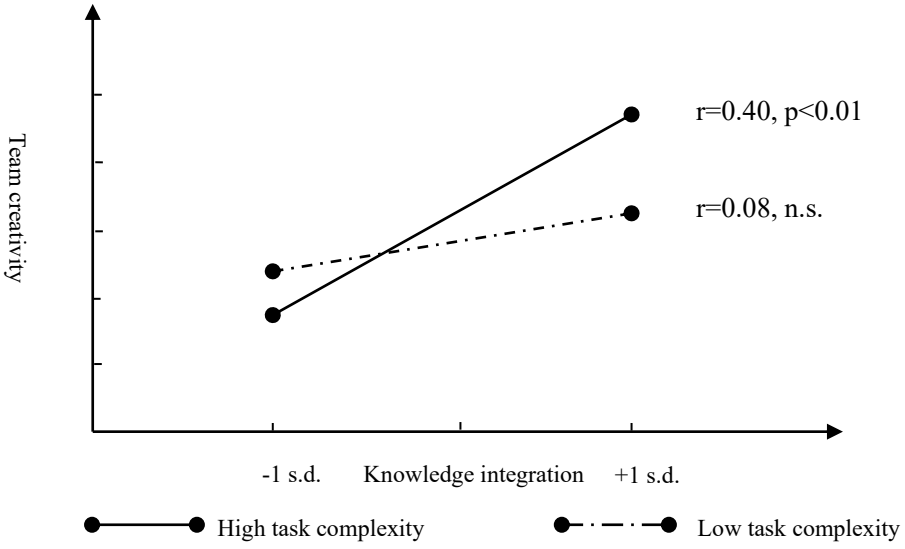


Figure 6.10 Interactive effects of knowledge integration and task complexity on team creativity

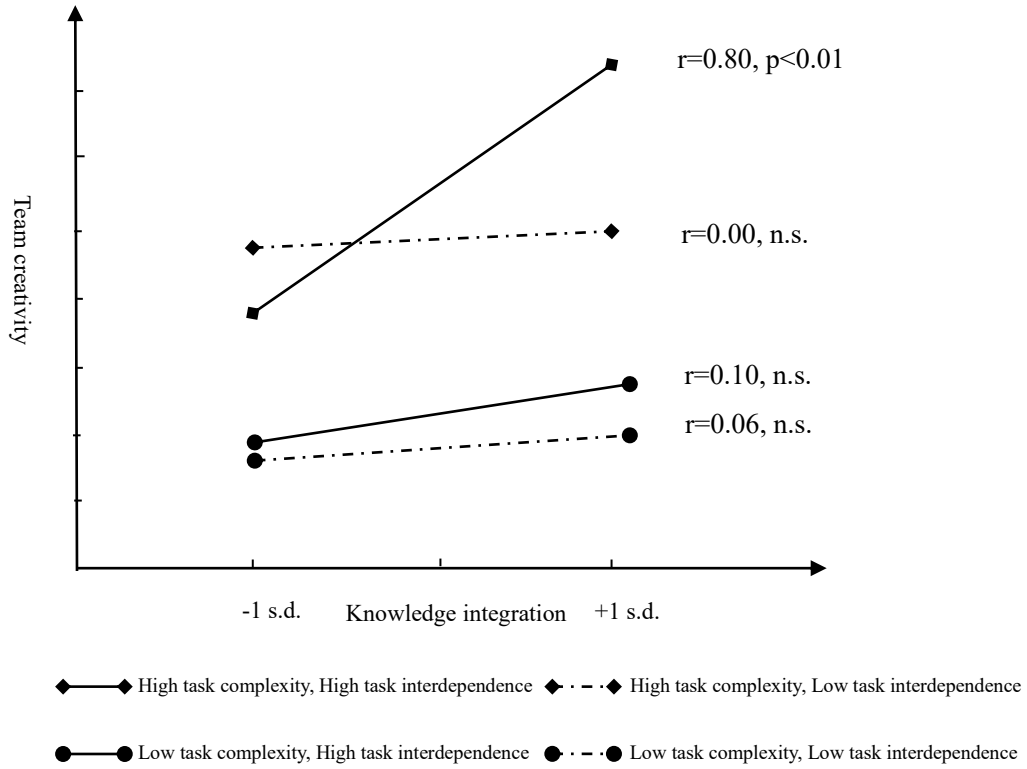


Figure 6.11 Interactive effects of knowledge integration and task complexity and task interdependence on team creativity

6.6 Summary

In this chapter, first, we introduced the research processes, which mainly include sample selection, data collection, and data analysis. Second, descriptive statistics and correlations of variables were presented. Third, a confirmatory factor analysis was conducted using individual-level data to examine the distinctiveness of our scales for the elaboration of external knowledge search, internal knowledge sharing, absorptive capacity, knowledge integration, task complexity, task interdependence, environmental dynamism, and team creativity. Finally, Hypotheses were tested using mathematical statistics method. For example, we assessed within-team agreement before aggregation by using R_{wg} (James, DeMaree & Wolf, 1984), ICC1 and ICC2 (Bliese, 2000); we ran tests following the procedure recommended by Baron and Kenny (1986) to examine the mediating roles of absorptive capacity and knowledge integration. In sum, our research model was generally supported.

Conclusions

7.1 Theoretical and practical implications

7.1.1 Theoretical implications

This study makes several theoretical contributions to the knowledge management and team creativity literatures.

First, we explored the trigger factors of knowledge acquisition by using a case study. More specifically, our study explored the trigger factors of external knowledge search and internal knowledge sharing. Althouth prior work has explored the antecedents of external knowledge search (Zhao & Li, 2016). However, they mainly focused on organizational level and did not explore the influencing factors of external knowledge search at the individual level and team level. In addition, most research on knowledge sharing centers on empirical studies (Hamel,1991; Wang & Yang, 2007; Anwar, 2017), however, little attention has been given to systematically examining the trigger factors of knowledge sharing through case studies. Results showed that the trigger factors of external search and internal knowledge sharing includes cognitive triggers and intrinsic triggers; Calling-orientation and personality are intrinsic triggers, while career-orientation, team climate, organization/team culture, relationship perception, and organizational strategy are cognitive triggers. Further, career-orientation and calling-orientation are dynamic elements. Personality is a basic element. However, team climate, relationship perception, and organization/team culture are situational elements.

Second, we explored the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and team creativity. Previous research has examined the relation between external knowledge search and individual creativity (Soo et al., 2007). However, according to Shin, Kim, Lee, and Bian (2012), team members may respond differently to the same context, it is premature to predict that external knowledge search would have the same effect on

team creativity as it has with individual creativity. Thus, to address this gap in the literature, we develop and test a theoretical framework on how external knowledge search unfolds and operates to affect team creativity. In addition, Huang et al. (2014) have examined the relation between knowledge sharing and team creativity. However, they did not investigate the underlying influence processes, leaving unclear how knowledge sharing affects team creativity. Thus, to address this gap in the literature, we develop and test a theoretical framework on knowledge sharing unfolds and operates to affect team creativity.

Third, we provide a test of the mediating mechanisms by which external knowledge search and internal knowledge sharing influence team creativity. Previous research on internal knowledge sharing focused on either an emergent state or on a team process as the mediating mechanism (Bao et al., 2016; Liao et al., 2007). However, our study examined the intervening roles of both absorptive capacity as an emergent state and knowledge integration as a team process. Including these two categories of mechanisms in one model makes it more inclusive in terms of the heuristic model of team effectiveness (Cohen & Bailey, 1997). Our study indicates that both absorptive capacity and knowledge integration are important intervening variables in the relationship between knowledge acquisition and team creativity, even when their effects are considered simultaneously. More specifically, we argue that external knowledge search and internal knowledge sharing may influence team creativity via absorptive capacity, because external knowledge search and internal knowledge sharing can broaden a team's existing knowledge base and enhance team members' learning ability (Liao et al., 2007), which will in turn influence team members' ability and motivation to recognize, assimilate, and apply knowledge, and ultimately affect team creativity. External knowledge search and internal knowledge sharing also influence team creativity via knowledge integration. External knowledge search and internal knowledge sharing require team members to search and share knowledge and expertise that underlie their abilities to learn and participate in appropriate actions to create new architectural knowledge by integrating component

knowledge. It will positively influence a team's knowledge integration process, thereby affecting team creativity. In general, our study shows the potential influence of external knowledge search and internal knowledge sharing and that their effects on team creativity are exerted through absorptive capacity and knowledge integration.

Fourth, another noteworthy finding is that environmental dynamism plays an important role in prompting team members engage in external knowledge search, assimilate and integrate the externally generated knowledge for creative outcomes. This study not only theoretically developed the interaction effect on team creativity by integrating research on external knowledge search, absorptive capacity, knowledge integration, environmental dynamism, and team creativity, but also empirically demonstrated the moderating roles of environmental dynamism in the relationship between external knowledge search and absorptive capacity, as well as in the relationship between external knowledge search and knowledge integration.

Fifth, task complexity and task interdependence are key boundary conditions under which absorptive capacity and knowledge integration influence team creativity. As previously discussed, when both task complexity and task interdependence are high, team members are more likely to absorb and integrate their task-related knowledge and skills, which in turn will be beneficial to team creativity. Conversely, when the task has low complexity and /or low interdependence, team members are less likely to absorb and integrate knowledge. Thus, our three-way interaction result provides an important implication that both task complexity and task interdependence are necessary for absorptive capacity and knowledge integration to influence team creativity.

7.1.2 Practical implications

Our findings also provide interesting practical implications for managers and employees. First, given that external knowledge search plays an important role in influencing team creativity, managers should encourage team members to invest in searching for high quality knowledge; for example, team members can search external

knowledge from customers, suppliers, competitors, universities, and research institutions. This would be worthwhile because it would activate the motivational forces that drive team members to engage in their work roles. Engaged employees tend to be more creative, responsive and vigilant (Gino & Todorova, 2010), and therefore are better able to meet challenges resulting from today's dynamic technological environments. In addition, our study has shown that team members' internal knowledge sharing promotes absorptive capacity and knowledge integration and, thus, team creativity. This result can serve as advice to managers should find a way to encourage internal knowledge sharing between coworkers. Knowledge sharing can be an effective knowledge management tool influencing team creativity (Bodla et al., 2016; Zhang et al., 2011). In organizations where team members' knowledge, suggestions, and opinions have critical implications for organizational functions, managers should pay more attention to their display of positive encouragement in team members' knowledge sharing, because showing positive encouragement to knowledge sharing can increase team members' absorptive capacity and promote knowledge integration in generating new ideas. Moreover, organizations should implement training programs to teach managers how to encourage knowledge sharing. Simultaneously, organizations should invest in training programs to help team members develop better interpersonal skills. According to "what goes around comes around" (Cerne et al., 2014: 188), employees who willingly share more knowledge seem bound to then in turn receive such selfless treatment from their colleagues, which will ultimately encourage them and prompt their creativity. Therefore, team members should engage in more knowledge-sharing behavior in order to facilitate their own creative ability and team creativity.

Second, in highly dynamic environments, teams are more likely to search external knowledge instead of relying on internal sources. However, if the external knowledge is not absorbed and integrated by team members, external knowledge will not be translated into team creativity. Thus, managers should place more emphasis on the accumulation of knowledge base, which can enhance teams' absorptive capacity

and prompt knowledge integration. Simultaneously, managers should staff their teams with employees with high individual absorptive capacity, because team members with broad expertise, knowledge, and cognitive skills are more likely to generate new ideas to solve problems (Lowik et al., 2016; Shin et al., 2012).

Third, our study also suggests that absorptive capacity and integration play mediating roles in the relationship between knowledge acquisition (including external knowledge search and internal knowledge sharing) and team creativity. Thus, managers should take measures to improve team absorptive capacity. For example, managers can staff their teams with employees with high individual absorptive capacity, because team members with broad knowledge, expertise, and cognitive skills are more likely to generate creative ideas to solve problems (Lowik et al., 2016). Additionally, managers can enhance team members' absorptive capacity and prompt knowledge integration by broadening teams' knowledge base. According to Grand et al. (2016), knowledge emergence in teams is mainly driven by external knowledge search and internal knowledge sharing. Thus, in order to broaden teams' knowledge base and increase team absorptive capacity and prompt knowledge integration, managers can also take steps to prompt external knowledge search except for internal knowledge sharing.

Fourth, our study has found that the positive effects of absorptive capacity and knowledge integration on team creativity are stronger with higher task interdependence, and weaker with lower task interdependence. Thus, managers can enhance team creativity by strengthening within-team task interdependence. For example, a high task interdependence workflow (such as creating high outcome interdependence and giving feedback) can be designed by managers, which can prompt team members to center more on the collective team interest (Huo et al., 2016).

7.2 Limitations

Despite its contribution to theory and practice, our study has several potential

limitations.

First, although we collected data from different sources to reduce potential common method biases, we still can't draw conclusions about causality from a cross-sectional study. A longitudinal design measuring the variables with time lag would be necessary. That is, there should be a meaningful time lag between measures of internal knowledge sharing (as well as external knowledge search), absorptive capacity, knowledge integration, and team creativity.

Second, our study examined perceived task complexity and perceived task interdependence instead of actual task complexity and task interdependence. Compare with actual diversity, perceived diversity that is frequently used in diversity research can explain team members' behavior more strongly. However, individuals may not assess other team members' cognitive diversity accurately, and the assessment is likely to be biased (Harrison & Klein, 2007; Shin et al., 2012). Future research should compare the moderating role of perceived cognitive diversity and actual cognitive diversity in the relationship between internal knowledge sharing and team creativity.

Third, we measured internal knowledge sharing by asking team members to describe the extent to which they share explicit or tacit knowledge with their colleagues. A more effective way to measure knowledge sharing in teams would be using a round-robin design or taking social networks (Warner, Kenny & Stoto, 1979). For example, the round-robin design would require every team member assessing its experience of sharing knowledge with other members of the team. Then, the results should be aggregated at the team level (Huang et al., 2014). These two approaches would measure knowledge sharing in teams more accurately.

Fourth, we did include other plausible variables that moderate the relationship between internal knowledge sharing (external knowledge search) and team creativity. For example, research on creativity suggests that intrinsic motivation is one of the most critical factors for creativity (Amabile, 1996). If team members have high levels of intrinsic motivation, they may be willing to search for and integrate different knowledge and ideas, which is likely to strengthen the positive relationship between

internal knowledge sharing (external knowledge search) and team outcomes. Future research in examining this moderating role in the relationship between internal knowledge sharing (external knowledge search) and team outcomes is required.

Fifth, according to Jansen et al. (2005), absorptive capacity is comprised of four dimensions: identification, assimilation, application, and utilization. We did not directly test how external knowledge search and internal knowledge sharing influenced the four dimensions of absorptive capacity. Future research should examine the relation between external knowledge search (knowledge integration) and the four dimensions of absorptive capacity in dynamic environments separately.

Sixth, reverse causality for some of our relation is possible. For example, teams with higher absorptive capacity are more likely to explore new knowledge through external knowledge search and internal knowledge sharing, because they are more capable of assimilating and integrating new knowledge. Future research should adopt a longitudinal or experimental design to demonstrate the direction of causality.

Seventh, to minimize potential common method biases, we collected data from two different sources. Team members reported on external knowledge search, knowledge sharing, absorptive capacity, and knowledge integration, while team leaders reported on team creativity. However, knowledge search/knowledge sharing and absorptive capacity are evaluated by team members at the same time. We can not rule out the potential common method biases. Future research should adopt a longitudinal or experimental design to minimize potential common method biases

In addition, although we explored the trigger factors of knowledge acquisition through a case study. More specifically, we explored the trigger factors of external knowledge search and internal knowledge sharing through a case study. Future research should use empirical studies to examine the relationship between the trigger factors (e.g., conflict, trust, and strategy) and knowledge acquisition.

Appendix A interview outline

Knowledge acquisition：

In your team, what are the main ways to acquire knowledge? Please give us some examples.

Internal knowledge sharing：

(1) As is known, knowledge sharing is very important in a team. Do you share your experience, expertise, knowledge, and skills with colleagues? How? Give us some examples.

(2) Do you share your knowledge actively or passively? Why do you share your knowledge? More specifically, what factors may prompt you to share your knowledge with colleagues. In addition, which factors do you think are very important? Why? Please give us some examples of your experience to share your knowledge, skills, and expertise with colleagues. These examples should include time, people, and events.

(3) If there are some situations in which you are not willing to share your knowledge with your colleagues and supervisors. What factors may prompt you to do that? Please give us some examples. If the situations are opposite, what will you do? Why?

(4) Are your colleagues willing to share their expertise, knowledge, and skills with you? What factors do you think may prompt them to share their knowledge? Are they voluntary or enforced? Please give us some examples? If it were you in those situations, what would you do?

Or, what is the reason that your colleagues don't want to share their knowledge? Please give us some examples?

(5) How do you feel about the role of knowledge sharing in your team? That is, what effects does knowledge sharing have on team outcomes? Please give us some examples?

(6) What is the effect of knowledge sharing on the production of novel and useful ideas? Why? What is the process? Please give us some examples.

External Knowledge search

(1) As is known, external knowledge search is also important in a team. Do you often search work-related knowledge and information? What kinds of ways do you use? Please give us some examples.

(2) Do you search external knowledge actively or passively? Why do you search knowledge? More specifically, what factors may prompt you to search external knowledge. In addition, which factors do you think are very important? Why? Please give us some examples of your experience to search work-related knowledge and information. These examples should include time, people, and events.

(3) Does your leader or colleagues search work-related knowledge from universities, research institutions, markets, and other departments? What factors do you think may prompt them to search work-related knowledge? And what is the most important reason that he or she searches external knowledge.

(4) How do you feel about the role of external knowledge search in your team? That is, what effects does external knowledge search have on team outcomes? Please give us some examples?

(5) What is the effect of external knowledge search on the production of novel and useful ideas? Why? What is the process? Please give us some examples.

Appendix B open coding of raw materials

Raw materials	Labels
M1: I work at media application. Communication is an important way to acquire work-related knowledge.	a1: communication
M1: Sometimes I acquire knowledge from my colleagues.	a2: from my colleagues
M1: For example, one previous project needed a specialized software (streaming media). However, we did not have this software. We designed a new one to replace this software because we can reduce our cost and because we can have our own intellectual property. More specifically, first, we searched relevant solutions which were provided by Intel. Second, we conducted a parameter analysis and reported the results. Finally, the whole project team members had a further discussion and shared relevant knowledge to other departments.	a3: project needed
	a4: designed a new software
	a5: intellectual property
	a6: reported the results
	a7: further discussion
M1: When I go out to learn new skills or communicate about work-related matters, I will pay attention to some new techniques, which is helpful for the production of novel and useful ideas.	a8: go out to learn new skills
	a9: novel ideas
	a10: useful ideas
M1: Of course, when I come back, I will share these new techniques with my colleagues. Sometimes, we may analyze the technical feasibility and market possibility to generate some new ideas.	a11: share new techniques
	a12: technical feasibility
	a13: new ideas
M1: When my colleagues requested work-related knowledge, I will share my knowledge with them, because knowledge sharing can help them to accomplish their work successfully, which in turn will be beneficial for the whole project. Sometimes, I would like to actively share my knowledge with colleagues.	a14: colleagues request
	a15: accomplish their work successfully
	a16: actively share
M1: Also, knowledge sharing is supported by our leader. Most of the time, work requirements prompt knowledge sharing.	a17: supported by our leader
	a18: work requirements
M1: I would like to share my knowledge with colleagues because knowledge sharing can prompt communication and maintain good relationship. Sometimes, I will proactively search knowledge. For example, we needed AVC video coding (H. 264). However, there was no related knowledge in our knowledge base. Thus, we had to search AVC coding standard documentation from other sources.	a19: communication
	a20: would like to
	a21: search AVC coding standard
M1: Recently, CDN has been popular. We tried to connect IPTV system to CDN to reduce the cost of server acquisition and maintenance. More specifically, we exploited the net supplied by CDN to extend our business. Of course, our supervisor encouraged us to understand and stock CDN-related knowledge.	a22: reduce the cost
	a23: extend our business
	a24: understand and stock related knowledge
M1: When we absorb and assimilate some work-related knowledge, we are more likely to generate new ideas.	a25: absorb and assimilate some work-related knowledge
	a26: new ideas

M1: In fact, only searching external knowledge is not very helpful for us. The key is to absorb this knowledge and transfer it into our own.	a27: absorb
	a28: transfer
M2: I work on geology. I am good at structural analysis and water-filling analysis in hydrogeology. Sometimes I look up related books and papers to acquire work-related knowledge. This can help me to absorb others' knowledge quickly. Also, this can help us to integrate our specific situation with acquired knowledge to generate proper solutions.	b1: look up related books
	b2: absorb
	b3: integrate specific situation
	b4: proper solutions
M2: There are two reasons to search external knowledge. One is organizational requirements. The main aim of our company to engage in project is for profit. Accordingly, we need to search work-related knowledge and solve project problems. The other is personal requirements. Project engagement can improve employees' skills and expertise.	b5: organizational requirements
	b6: personal requirements
M2: Most of the time, I may share my knowledge with colleagues. Sometimes, I would not like to share my knowledge with colleagues because I compete with them.	b7: compete with them
M2: For example, when I participate in a project, I will share my knowledge and thoughts with colleagues. This is work requirement. No one can avoid knowledge sharing.	b8: discussion
	b9: work requirements
M2: If I have a good relationship with one of my colleagues, I will share my knowledge. In other words, if I do not compete with her or him, I will share my knowledge.	b10: compete with her or him
	b11: have a good relationship
M2: In all, I will share my knowledge either for work requirements or for interpersonal trust.	b12: work requirements
	b13: interpersonal trust
M2: If I compete with him or her, I will not actively share my knowledge. In my unit, employees prefer to take more time to study instead of asking those colleagues who they compete with for help because they disagree with each other.	b14: actively share
	b15: take more time to study
	b16: disagree with each other
M2: If I cannot find a solution after many hours of research, I may ask my colleagues for help. However, they may hide critical knowledge and skills from me. In fact, this team climate is not good.	b17: ask for help
	b18: team culture
M2: We have some problems in management, such as treating employees unfairly. If you are treated unfairly, you may not share your knowledge with colleagues.	b19: treating employees unfairly
M2: For example, one of my colleagues makes less contribution to the overall performance of our work unit than me. However, he has a similar wage and treatment with me. In addition, our supervisor often praises him. Thus, I may feel unfair and keep selfish. More specifically, I may try my best to improve myself and not share critical knowledge with colleagues.	b20: feel unfair
	b21: selfish
M2: In such a cultural context, employees cannot share their	b22: cultural context

knowledge actively with colleagues.	
M2: There are many sophisticates in our team. If they frown upon your behavior, they will not listen to you and make trouble. Of course, unfairness may lead to jealousy. Sometimes, employees who are excellent may be more likely to be envied under unfair conditions.	b23: unfairness
	b24: be envied
M2: If our supervisor treats us fairly, we may be more likely to share our knowledge with colleagues. Of course, I wish my supervisor and colleagues to treat me fairly. Thus, we can cooperate with each other.	b25: treats us fairly
	b26: cooperate with each other
M2: Each company has a knowledge base. Some knowledge is presented in words. Some knowledge is in the mind of employees and can be influenced by personal values, beliefs and experience, Leaders encourage employees to transform the knowledge in their minds into words and keep updating companies' knowledge base. However, employees would not like to share their vital knowledge.	b27: knowledge base
	b28: presented in words
	b29: is in the mind
	b30: leaders encourage
M2: It is not safe for leaders because employees may quit their jobs. Consequently, leaders try to translate employees' vital knowledge into words.	b31: quite their jobs
M2: If my leader treats me unfairly, I will hide my vital knowledge. That is, I will share my vital knowledge as little as possible.	b32: hide my vital knowledge
	b33: not share knowledge
M2: For example, I am responsible for one part of the project. At last, I will make out a report. In the report, I may tell my colleagues how to operate. However, I will not tell them the process and how to design this formula.	b34: process
	b35: design this formula
M2: For example, we needed to improve the mining limit to obtain more coal resources. However, the mine's hydrogeological condition is special, and we cannot solve this problem using a traditional method. Accordingly, we need to find new ways to solve this problem.	b36: solve this problem
	b37: find new ways
M2: After a long time discussion, we developed a new technology according to deposition theory. More specifically, we separated the aquifer from the aquifuge and analyzed the water filling. Thus, we knew the mining limit. In the whole process, everyone needs to express individual viewpoints and share his knowledge because this project needs a lot of geology-related knowledge.	b38: a long time discussion
	b39: share his knowledge
M2: Where does this geology-related knowledge come from? It is acquired by searching relevant data and literatures. Sometimes, we will search work-related knowledge from other companies and universities.	b40: searching relevant data and literatures
	b41: search work-related knowledge from companies
	b42: search work-related knowledge from universities
M2: Now the whole geological prospecting industry is in depression. About 90% of the coal industry is operating at a loss.	b43: prospect
	b44: keep original

Moreover, the prospect of coal industry is not good, because coal is non-renewable resources and because it can cause serious pollution problems. Now, our leader is considering company transformation. One way is to keep the original development. However, we should reduce the cost. Another way is transforming to other business. Anyway, I will either learn new work-related knowledge or quit my job.	development and reduce the cost
	b45: company transformation
	b46: transforming to other business
M3: I work on project planning, and I acquire work-related knowledge from internal communication.	c1: internal communication
M3: For example, when we have a meeting, leaders' statements and colleagues' viewpoints can make me acquire a lot of work-related knowledge. In addition, team cooperation can help me to be familiar with colleagues' task.	c2: leaders' statements
	c3: colleagues' viewpoints
	c4: team cooperation
	c5: be familiar with colleagues' task.
M3: In our team, we are preparing for Cloud Promotion, and I am responsible for copywriting. In this whole process, I will actively communicate task-related knowledge with my colleagues. Thus, I can clarify the feasibility of my copywriting and make a revision according to colleagues' viewpoints.	c6: actively communicate
	c7: clarify the feasibility
	c8: be responsible for
M3: Sometimes I may search the internet for work-related knowledge. For example, one time my supervisor asked us whether we can use the software—Axture. However, no one knew how to use it. At that time, I was curious about this software and wanted to know how to use it. Consequently, I searched the relevant knowledge about how to use Axture.	c9: search the internet for work-related knowledge
	c10: was curious about
M3: In our team, we have a culture which emphasizes learning. More specifically, our supervisor often encourages us to learn work-related knowledge to enrich our professional skills. Also, our supervisor encourages us to share our knowledge with colleagues.	c11: emphasizes learning
	c12: supervisor encourages
M3: In order to improve my professional skills and core competitiveness, I may search work-related knowledge in my spare time. It is helpful to increase my salary.	c13: improve my professional skills
	c14: work-related knowledge
	c15: core competition
	c16: increase my salary
M3: It is not easy for me to write a good copywriter because my supervisor often requires the copywriter to be novel and there are no ready-made templates. In addition, I need to actively search plenty of raw materials. This is task requirement. Also, I may be initiative to search work-related knowledge. This is related to my personality.	c17: to be novel
	c18: no ready-made templates
	c19: search plenty of raw materials
	c20: initiative
	c21: task requirements
M3: I can collect data, information, and materials on the internet. Sometimes, I may go to other companies to collect data. Also, I may conduct market research.	c22: go to other companies to collect data
	c23: conduct market

	research
	c24: on the internet
M3: I would like to share my knowledge with colleagues. I have been working in the company for two years, and I have been familiar with my business. Last year, we employed a new staff, and our supervisor asked me to share my work experience and skills with him.	c25: business knowledge
	c26: our supervisor asked
M3: Sometimes, I would like to share some work-related knowledge which was acquired on the internet.	c27: would like to share
M4: I acquired knowledge mainly from the network, my colleague, and my friends.	d1: acquired knowledge from colleagues and friends
	d2: acquired knowledge from network
M4: Work requirement also prompts me to search related knowledge. In addition, if I am interested in something new in my work, I will search relevant knowledge.	d3: work requirement
	d4: interested in
M4: For example, we are engaging a project which is based on based on c++. However, I am familiar with android-related work which is based on C and Java. Thus, I need to learn by doing. More specifically, when I have troubles in understanding the function and structure, I will search related knowledge from the network. Also, I will ask my colleagues for help.	d5: learn by doing
	d6: ask my colleagues for help
M4: Of course, if my colleagues have troubles, they also will ask me for help. I will try my best to help them to solve the problems.	d7: ask me for help
M4: Not all searched knowledge is helpful for us. More importantly, we should absorb knowledge and learn how to utilize acquired knowledge. Sometimes, we need to exploit and integrate others' source code to develop new software.	d8: absorb knowledge
	d9: utilize acquired knowledge
	d10: integrate others' source code
	d11: a new software
M4: Daily work communication such as meeting is the main way to share knowledge. At the meeting, everyone should report his or her project progress and issues.	d12: project progress and issues
M4: Work requirement is the main aim to share knowledge. Everyone will share his or her knowledge at the meeting.	d13: work requirement
M5: Relevant materials search and internal communication are two main ways to acquire work related knowledge.	e1: relevant materials search
	e2: internal communication
M5: I search external knowledge because my work requires plenty of knowledge and information.	e3: work requires
M5: For example, when I make a planning adjustment project, I need to search project-related documents, progress, and project templates.	e4: search project-related documents
	e5: search project templates
M5: In addition to in-role work requirements, interest is also crucial to external knowledge search.	e6: work requirements
	e7: interest

M5: Work requirements mainly include the request from my colleagues and supervisor.	e8: work requirements
M5: For example, one time my supervisor required the material about the progress of land improvement project. Accordingly, I searched the relevant materials from the territorial resources database or newspapers and wrote them in words.	e9: searched materials from database
	e10: searched materials from database
M5: In fact, innovation is difficult for us because we need to exploit and integrate other team members' knowledge.	e11: integrate
	e12: exploit other team members' knowledge
M5: I would like to communicate with my colleagues and share my knowledge. For example, one of my colleagues tried to output CAD (A0) in the format of jpg, and he did not know how to operate. I taught him how to export the image format. Of course, if I have trouble in my work, I will ask my colleagues for help.	e13: communicate with my colleagues
	e14: colleagues' requirement
	e15: have trouble in my work
M5: We communicate with each other frequently. For example, we often share the latest technology and work-related information with one another. I think this is related to the cooperation atmosphere in our team.	e16: communicate with each other
	e17: cooperation
M5: On the one hand, we cooperate because we trust each other. On the other hand, we cooperate with each other because we have shared goals. Partnership emphasizes cooperative security, mutual benefits to create a win-win situation, and positive recognition.	e18: trust
	e19: win-win situation
M5: In fact, knowledge sharing is the first stage of problem-solving process, and how to use knowledge is the second stage of problem-solving process. Employees should understand and digest the knowledge shared by their colleagues.	e20: use knowledge
	e21: digest the knowledge
M5: Only if you digest and absorb the knowledge, you can integrate your knowledge with others, which in turn will be helpful to generate novel ideas.	e22: integrate your knowledge
M5: In our company, we may have a material base. One famous sample is Petwin which has a circular hollow dome and integrates many enterprise elements.	e23: integrates enterprise elements
M5: In the process of planning and design, we emphasize imitation. Also, we stress team cooperation to integrate employees' diverse knowledge. In all, if a product designed by our team is novel and well presented, it will be creative and successful.	e24: imitation
	e25: team cooperation
	e26: novel
	e27: be creative and successful
M5: What is creativity? Problem-solving is the core of creativity. Of course, creativity should be practical.	e28: creativity
	e29: practical
M6: I think there are two ways to acquire knowledge: One is from inside (e.g., internal communication); the other is from outside (e.g., customers, suppliers, and dealers).	f1: internal communication
	f2: from outside
M6: As a team supervisor, I have the duty to share my knowledge with employees.	f3: have the duty
M6: I trust our company, and I am very optimistic about the future development prospect of our company. This trust prompts me to share the most recent information at the meeting.	f4: trust

M6: Also, I should select and nurture a successor. If an employee has good individual ability and is trustworthy, I will actively share my expertise and skills with him. This can help him grow up quickly.	f5: actively share my expertise and skills
	f6: trustworthy
M6: We have a meeting every month. At the meeting, each department supervisors (e.g., sales department, planning & design department, and R&D department) will introduce the progress of their work. This is work requirement.	f7: work requirement
M6: Knowledge sharing can help us to understand what the employees in other departments are doing. Diverse knowledge should be utilized and integrated to produce new product. Also, we should consider the future prospect of the product.	f8: be utilized and integrated
	f9: the future prospect
M6: Communication should be open. More specifically, everyone should participate in knowledge exchange and absorb work-relevant experience.	f10: absorb work-relevant experience
M6: For example, if the supervisor of marketing department wants to develop a new product, he should share product-relevant information and provide a product development proposal. Then, we will evaluate this program. If the product is approved, we will design this product, and send the sample to the customer. Accordingly, the customer may provide feedback on the product. Finally, the whole procedure and relevant materials will be transferred to the production department. This means a new product has been developed.	f11: knowledge sharing
	f12: develop a new product
M6: I think the main motivation to search knowledge is work requirement.	f13: work requirement
M6: In addition to work requirement, culture is another motivation to search knowledge. For example, we have a learning-oriented culture. More specifically, we train our employees to acquire diverse knowledge and improve their skills. This is our advantage. However, in small companies, leaders would not like to establish corporate culture and vision. Also, they would not like to invest a lot to train their employees.	f14: a learning-oriented culture
	f15: acquire diverse knowledge
	f16: improve skills
	f17: corporate vision
M6: The other change is business model. We used to be OEM, and now we develop our own products. In the process of business model transformation, we need to recruit some new employees and fire some employees. More specifically, if you would not like to learn new skills and technologies, you may be fired.	f18: develop our own products
	f19: transformation
	f20: learn new skills
	f21: business model
M6: Business model transformation can influence knowledge search. For example, you want to give up an existing product and develop a new product. This is a complicate process. More specifically, you need to analyze the technical feasibility and provides various materials.	f22: develop a new product
M6: Recruiting new employees is a process of knowledge search because new employees can bring diverse knowledge to our team and company. Of course, most of the new employees are younger because they are more willing to study.	f23: recruiting new employees
	f24: willing to study

M6: Every year, I prepare a fund of money to encourage employees to learn specialized expertise and skills from universities or other companies, because it is a good opportunity to increase employees' knowledge.	f25: encourage
M7: Of course, if there are good cases, I will share them with my colleagues. This is work requirement. Also, it is fun to share work-related knowledge.	g1: work requirement
	g2: fun
M7: Sometimes, I would not like to share my knowledge with colleagues, especially, when I have a conflict of interest with my colleagues.	g3: a conflict of interest
M7: Also, work division may prompt you to share knowledge. For example, you may share your work-related knowledge with new comers in your department.	g4: share knowledge
	g5: work division
M7: It is work requirement. You have to do it.	g6: work requirement
M7: One time I was responsible for introducing the course "win in the cloud". I used the five elements on WeChat page to analyze the process of resources integration. Our courses can help small and medium enterprises to establish their "R &D space" and "resource platform".	g7: resources integration
M7: WeChat is one of the most popular tools in our social network. When we open the software—WeChat, we'll notice that there is a person standing next to the vast blue planet. I am curious about this scene and search relevant information. The reason is that Chair Ma gave Zhang Xiaolong sufficient imaginations and resource platform.	g8: curious about
	g9: imaginations
M7: Real estate planning needs a lot of professional knowledge, such as image, construction, fire control, budget, and land evaluation. While marketing planning, which focuses on market research, market positioning, and price positioning, emphasizes more on knowledge and innovation.	g10: image
M7: As marketing planners, we should know the latest development of marketing. If we know more information, we will communicate with my colleagues easily. Also, we can share and use this knowledge flexibly.	g11: communicate with my colleagues
	g12: share
	g13: use this knowledge flexibly
M7: Communication is very important. We should communicate with customers to catch their ideas. Also, we should cooperate with employees in other departments, such as sale department, engineering department, and property department.	g14: communication
	g15: cooperate with employees
M7: We should learn to image. For example, when we see a glass, we should image the whole process of producing, transporting, and marketing. Also, we should consider how to integrate other elements.	g16: image
	g17: integrate
M7: In fact, planning is to solve problems. For example, if customers reflect that the price of a product is high, we may take promotion activities.	g18: solve problems
M7: In fact, creativity is to solve problems.	g19: creativity

	g20: solve problems
M7: Programs and ideas are very important for us.	g21: program and ideas
M7: Good ideas are discussed over and over again. It is difficult to get a brilliant idea without a spark of thought.	g22: ideas
	g23: a spark of thought
M7: Sometimes, I search work-related knowledge from the internet, such as top copywriters. Work-relevant information and knowledge may give me some enlightenment.	g24: enlightenment
M7: In fact, results are more important than novel ideas.	g25: novel ideas
	g26: results-oriented
M7: What is result-orientation? For example, we sale commercial houses. The most important result is sales performance instead of customer satisfaction.	g27: sales performance
M7: How to produce novel ideas? Where does this work-related knowledge come from? One is interest. More specifically, I would like to be initiative to search work-related knowledge which I am interesting in. The other is work requirement. That is, I have to search work-related knowledge to solve problems.	g28: actively search
	g29: ideas
	g30: work requirement
	g31: interesting in
M7: Searching information and knowledge from my colleagues can help me to integrate diverse resources and to come up with novel ideas.	g32: integrate diverse resources
M8: At the beginning, I need to learn a lot. I visited BBS and bought may books to improve myself. Later, I began to pay attention to the latest development of Android system. It is work requirement.	h1: work requirement
M8: Sometimes, it is my personal interest. For example, I am interested in the Fragment of Android 4.0, and I will search relevant knowledge.	h2: personal interest
M8: I would like to share information and knowledge with colleagues. For example, I will share some simple programs with my colleagues. When the simple programs are identified by my colleagues and praised by my supervisor, I will be more likely to share my knowledge.	h3: praised by my supervisor
	h4: identified by colleagues
M8: Sometimes, it is work requirements. For example, if I am in trouble, I need to share my problems with colleagues. Then, my colleagues can help me. Of course, I would like to share my knowledge with my colleagues because I feel happy when I share my knowledge.	h5: feel happy
	h6: help me
M8: Even if I become a team supervisor, I still would like to share my knowledge. On the one hand, it is my responsibility; On the other hand, I feel happy to help my subordinates to improve them. I am familiar with many fields, such as Android and Rupy. Most of the time, I can help my subordinates to solve all the problems.	h7: responsibility
M8: Due to work division, employees are assigned to different tasks. When an employee encounters problems, I will arrange his colleagues to help him. This is helpful to prompt team cooperation and resource integration.	h8: work division
	h9: resource integration
M8: In addition to responsibility, trust is also an important factor to prompt knowledge sharing.	h10: responsibility

M8: I trust my team members. Interpersonal trust can prompt me to share my knowledge actively, which in turn will improve team members' ability to solve problems.	h11: trust
	h12: share my knowledge actively
M8: There are technical differences between experienced employees and newly recruited staffs. Some employees don't trust newly recruited staffs and would not like to share core technology with them.	h13: do not trust
M8: I will make some help plans. For example, I will let old employees to help newly recruited staffs, such as providing advice for newly recruited staffs to solve problems. In fact, it is a process of knowledge sharing.	h14: solve problems
	h15: knowledge sharing
M8: We have a favorable atmosphere. Also, we have positive interpersonal relationships within the team. In addition, organizational culture can prompt us to share work-related knowledge actively.	h16: a favorable atmosphere
	h17: organizational culture
	h18: positive interpersonal relationships
M8: We have a favorable communication atmosphere; We have common topics and common interests, and we often play basketball at weekends. Of course, we also talk about my work such as the problems we meet.	h19: communication atmosphere
M8: Every week, we may share work-related knowledge and skills with each other.	h20: share work-related knowledge and skills
M8: In our team, we have sub-groups, such as Android group, Windows group, and IOS group. Sometimes we focus on specific topics, such as industry 4.0 and LOT. Everyone is asked to share their knowledge, expertise, and problems. This can help us to produce new ideas. For example, an employee is good at c++, and the other is good at designing. Knowledge exchange may be helpful to produce new ideas.	h21: new ideas
M8: The aim of a company is to make a profit, and the purpose of R&D teams is to produce new products.	h22: new product
M8: In the past, we used KPI. Now, we are using OKR. More specifically, a team makes an OKR, and team leader sets goals for employees. And OKR is used to measure the whole team performance.	h23: team performance
M8: For example, if new products are developed in advance and the project is accomplished ahead of time, our performance will be improved. Sometime, we are not able to achieve our goals.	h24: improve performance
M9: Work requirements prompt us to share our knowledge with colleagues. I hope that our company can establish a learning platform to help us to share knowledge. Also, our team can organize some activities to share knowledge.	i1: a learning platform
	i2: work requirement
M9: Most of the time, I would not like to share my knowledge with colleagues because I am introverted.	i3: introverted
M9: For example, when I compete with colleagues, I would not like to share my knowledge with others. Also, if I take a lot of time to acquire relevant knowledge, I will not share it with others.	i4: take a lot of time to acquire
M9: If you were me, we might do the same. You may not share	i5: team climate

some crucial knowledge. In fact, this is related to organizational and team climate. For example, if you are working in a performance climate, which emphasizes competition and goal achievement, you would not like to share your knowledge with colleagues.	i6: competition
M9: In fact, leaders are very important because they can create a mastery climate to encourage knowledge sharing. If employees who share knowledge are rewarded and employees who hide knowledge are punished, they are more likely to share knowledge instead of hiding knowledge.	i7: leaders
	i8: rewarded and punished
M9: Leaders assign tasks for employees, and ask them to solve problems by themselves. Also, leaders may require us to share our knowledge with each other.	i9: leaders require
M9: Sometimes, I actively search knowledge about HTML, CSS, and JS. Work requirement and personal interest are two main factors to prompt external knowledge search. Of course, we also should be conscientious to search work-related knowledge.	i10: work requirement
	i11: interest
	i12: conscientious
M9: CSS (web front-end), which emphasizes UI, space, and imagination, is related to creativity.	i13: imagination
M9: We need not only to code but also to design. In fact, we are not simply repeating instead of creating.	i14: creating
M9: The front end of Web is very complicate because it includes expertise in a wide range of disciplines and needs to harness knowledge on JS and frame function.	i15: harness knowledge
M9: Of course, learning how to exploit knowledge is crucial. We should learn to absorb, transform, and exploit knowledge.	i16: exploit knowledge
	i17: transform
M9: How to absorb knowledge? It needs a lot of practice.	i18: absorb knowledge
M9: Knowledge integration can prompt creativity. For example, if you combine the knowledge about JS and framework function, you will make a new discovery.	i19: knowledge integration
	i20: combine
M10: Work requirements may prompt us to share knowledge. Sometimes, I may actively share my knowledge with colleagues.	j1: actively share
M10: However, if it is inconvenient for me to tell my colleagues about some work-relevant knowledge, I will tell them the reason honestly. It needs time to establish a trust relationship, especially when we don't know each other.	j2: a trust relationship
M10: Of course, most of us are selfish. More specifically, if my unique experience, knowledge, and resources are shared with others, I may have no competitive advantage.	j3: selfish
M10: If I do not like one of my colleagues, I will not share my vital knowledge with him.	j4: not like
M10: Team culture is very important because it can not only influence the development of our team, but also influence knowledge sharing climate. Team culture can be influenced by organizational culture and leaders' personality.	j5: team culture
	j6: organizational culture
	j7: leaders' personality
M10: In my opinion, team leaders should encourage team members to share their knowledge. Also, team leaders should share their experience actively and treat team members fairly.	j8: leaders encourage
	j9: treat team members fairly

M10: Second, team leaders should establish reward and punishment rules. For example, employees who share more should be rewarded more.	j10: reward and punishment
M10: Team leaders should create a shared belief. In general, a leader plays an important role in knowledge sharing, and they should encourage team members to share knowledge. Of course, employees can produce new ideas through knowledge sharing.	j11: team leaders
	j12: a shared belief
	j13: encourage team members
	j14: produce new ideas
M10: In my opinion, team culture can influence knowledge sharing.	j15: team culture
M10: Team culture is a core value. If employees do not have a shared belief and goal, they are more likely to pay attention their own task performance instead of the whole team task performance. In all, team culture is very important. A learning culture can prompt team members to search external knowledge actively.	j16: team culture
	j17: search external knowledge actively
	j18: a learning culture
M10: What prompt me to search knowledge? For me, one is work requirement, the other is personal interest.	j19: personal interest
	j20: work requirement
M10: I will search and digest work-related knowledge which I am interested in. It can increase my expertise.	j21: digest
M10: One time I set the maximum data length of both TCP server and receiving buffer as 1500. However, there was data lost. I did not know why. In addition, I am curious about this result.	j22: curious
M10: I tried to find ways to solve this problem. However, I failed. At last, I asked my colleagues for help.	j23: solve this problem
M10: One colleague suggested me to insert the chunk list to solve this problem. However, it did not work. Then, I searched relevant knowledge from the net. At last, I solved this problem by changing the model to LT and setting the TCP Sockfd as asynchronization.	j24: from the net
M10: What is innovation? The innovation is to change our mind to solve problems.	j25: innovation
	j26: change our mind
M10: Of course, we should master plenty of knowledge and skills.	j27: master knowledge
	j28: master skills
M10: If you accumulate plenty of knowledge, you will use it flexibly, which in turn will be helpful to produce new ideas.	j29: new idea
M11: As a postgraduate student, knowledge acquisition is mainly from the communication with my supervisor and classmates. Also, I can acquire knowledge from relevant paper, thesis, and books.	k1: communication with my supervisor and classmates
	k2: from relevant paper, thesis, and books
M11: When I am unfamiliar with a new field, I will search relevant knowledge. In addition, when I write papers, apply a program, and make an investigation, I may search relevant knowledge.	k3: write papers
	k4: apply a program
	k5: make an investigation
M11: In particularly, when I write my thesis, I will search plenty of literatures to acquire relevant knowledge.	k6: thesis requires
M11: Also, our supervisor may require us to search relevant knowledge. For example, my supervisor has a foundation program	k7: supervisor requires

which is about indexed retrieval. In the process of applying this program, he asked us to search relevant knowledge.	
M11: In addition, personal interest also prompts knowledge search. For example, if I am interested in "fuzzy evaluation, I may actively search fuzzy-relevant knowledge.	k8: interested
M11: In fact, our supervisor's support also prompts us to search relevant knowledge. For example, in order to support our scientific research, our supervisor bought many books about arithmetic for us. If we meet problems, we will search relevant knowledge to solve it.	k9: supervisor's support
M11: We have a meeting every week. At the meeting, all students are asked to read a paper which is published in top Journals. For example, at the meeting, I elaborate the research gap, theory, method, and innovation points of a paper, and then we will discuss it.	k10: meeting's requirement
	k11: discuss
M11: We have a good knowledge sharing climate. For example, my senior fellow apprentice may actively share his thesis writing skills to me. Also, he can teach us how to pubic paper in CSSCI journals. This is a process of knowledge inheritance.	k12: sharing climate
	k13: actively share
	k14: knowledge inheritance
M11: Sometimes, I may share my professional knowledge actively. For example, I am interested in fuzzy search and evaluation, and I will share relevant knowledge in our team. Also, I may ask our colleagues to provide some suggestions to produce new ideas. In addition, team cooperation can prompt us to share our knowledge.	k15: share my professional knowledge actively
	k16: team cooperation
	k17: new ideas
M11: Sometimes, we would not like to share our knowledge. For example, one of my junior fellow apprentices shares his knowledge actively. However, my supervisor was not satisfied with what he did, and often criticized him. Then, he would not like to share his knowledge with us because he did not accept what our supervisor said.	k18: criticized
	k19: not accept
	k20: not like to share
M11: In fact, everyone may hide knowledge. For example, I would not like to share some core ideas, because others will do the same thing as I shared. There are conflicts of interest among us.	K21: share some core ideas
	K22: conflicts of interest
M11: Recently, I have been working on the topic of fuzzy search. Previous research mainly focuses on exact search. Now, we focus on fuzzy search. For example, if we search a key word "keel", relevant words such as keel, traditional Chinese medicine (TCM), stewing method will come out. This is a process of fuzzy search. When I am not clear about the knowledge I require, this method may be useful and effective.	k23: fuzzy search
	k24: useful and effective
M11: In this field, there are many open source software to be available. This requirement is demand-driven.	k25: demand-driven
M11: This is a big project. If we don't use open source software, we will take too much time to write new code. Thus, we can make a revision according to the open source software, such as adding new ideas to the open source software. In fact, this is an exploitative innovation process because it integrates existing	k26: exploitative innovation
	k27: new ideas
	k28: integrates existing algorithm and our own ideas.

algorithm and our own ideas.	
M11: Where does this idea come from? I think it mainly comes from the literatures I have read.	k29: ideas
M11: What we are doing is using open source software to build platforms. It is difficult because it deals with arithmetic program and needs plenty of experiments. When we meet problems, we can communicate and cooperate with each other to solve problems.	k30: communicate with each other
	k31: cooperate with each other
M11: I should be familiar with both algorithm and programming. Relevant knowledge can be accumulated through imitation and learning.	k32: learning
	k33: be accumulated
M11: It is very tired for us to do experiments and write high-quality papers. Our study also needs innovation. Innovation is based on the results of previous studies. It requires us to search, accumulate, absorb, and exploit work-related knowledge, which is helpful to build well-grounded power.	k34: accumulate
	k35: exploit knowledge
	k36: well-grounded
M12: I think that it is a pleasure to share my knowledge. Especially, when my knowledge can help my colleagues. Of course, it can meet my vanity.	l1: a pleasure
	l2: help my colleagues
M12: New employees would not like to share their knowledge because they are afraid of ridiculing by colleagues. Also, some new employees would like to share their knowledge, especially when they are extrovert.	l3: extrovert
M12: Team leaders are very important. Team leaders should serve as model roles and tell employees how to share and what should be shared. In addition, team employee should share vital knowledge with colleagues.	l4: team leaders
	l5: model roles
M12: We have knowledge sharing routines. Every employee in our team should share his or her knowledge at the meeting.	l6: routines
M12: Individual performance assessment may influence knowledge sharing. Would you like to share your vital knowledge in a mastery climate?	l7: performance assessment
	l8: in a mastery climate
M12: However, team performance assessment can prompt knowledge sharing.	l9: team performance assessment
M12: Knowledge sharing can be prompted by compulsive systems.	l10: compulsive systems
M12: In addition, knowledge sharing can be prompted by material rewards.	l11: material rewards
M12: Knowledge sharing can improve employees' absorptive capacity. The absorbed knowledge, experience, and skills can be applied to the actual project, which in turn will prompt content innovation, method innovation, and process innovation.	l12: absorbed knowledge
	l13: process innovation
	l14: content innovation
	l15: methods innovation
M12: Knowledge sharing needs to be documented. More specifically, our team should build a public platform for employees to share their knowledge.	l16: documented

M12: We have a learning culture. For example, we have sharing session and learning session which are based on knowledge exchange.	l17: a learning culture
M12: I may collect industry-relevant materials. Now, I am working on interaction design. At the early stage of the project, I will collect relevant information and analyze the development prospect of a product. It is my work requirement.	l18: collect industry-relevant materials
	l19: work requirement
M12: Also, we can produce new ideas through brainstorming.	l20: new ideas
M12: We should master multiple areas of knowledge, such as special knowledge about interaction design and visual design. In addition, we should have composite skills which can help us to integrate all kinds of knowledge and produce new ideas.	l21: master multiple areas of knowledge
	l22: composite
	l23: integrate all kinds of knowledge
	l24: produce new ideas.
M12: In our work, we should learn to cooperate with each other, share our knowledge, and absorb colleagues' knowledge.	l25: absorb colleagues' knowledge
M12: At work, I should not only share my knowledge, but also integrate colleagues' knowledge. This can help us to produce new products. In addition, team cooperation can prompt creativity, which in turn will improve team performance.	l26: new product
	l27: integrate colleagues' knowledge
	l28: team performance
M12: Of course, in order to acquire diverse knowledge and resources, I should develop trust relationships with my colleagues.	l29: trust relationships
M12: As an interaction designer, radical innovation is very difficult. Most of the time, we focus on incremental innovation which is based on existing knowledge.	l30: radical innovation
	l31: incremental innovation
M12: Innovation is based on previous knowledge accumulation.	l32: knowledge accumulation.
M12: In fact, everyone is unique. We should pay attention to employees' diverse ideas because they can prompt team creativity. More specifically, we should absorb and integrate colleagues' diverse knowledge, which is helpful to improve team creativity.	l33: absorb diverse knowledge
	l34: integrate knowledge

Appendix C questionaire

(Supervisor)

Dear Sirs/Madams,

We are conducting an academic research, and our research topic is the trigger factors of knowledge acquisition and its effect on team creativity. Thank you for your time to complete the questionnaire. Please read each question carefully, and answer these questions according to your experience. The questionnaire is only used for academic research, and we are assured of the anonymity of your responses. If the questionnaire is not completed or completed carelessly, it will affect the questionnaire quality of your whole team. Thank you for your help.

Basic information (please tick "√" or fill out relevant information at the horizontal line in accordance with your description)

(1) Your gender：Male ( ) Female ( )

(2)Your age： 25 and below ( ) 26-35 ( ) 36-45 ( ) Above 45 ( )

(3)Your tenure：3 years and below ( ) 3-10 years ( ) 11-20 years ( ) 20 years and above ( )

(4)Your educational level：Junior college or below ( ) Bachelor ( ) Master ( ) Doctor ( )

(5)Team size：10 people and below ( ) 11-20 people ( ) 20 people and above ( )

(6)Team age：3years and below ( ) 3-5years ( ) 5years and above ( )

Team creativity (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

Team members often come up with new ways and methods to solve problems.	1	2	3	4	5
Team members often put forward new ideas that are different from previous ones.	1	2	3	4	5
Team members often put forward new ideas which are different from conventional thinking.	1	2	3	4	5
Team members often develop and design unique products	1	2	3	4	5
Team members can design new products, which challenge the status quo of existing products.	1	2	3	4	5
Team members can produce new ideas in the process of product design and manufacturing.	1	2	3	4	5
Team members often come up with some practical solutions to solve problems	1	2	3	4	5

Team members can produce new ideas which have practical value.	1	2	3	4	5
Team members can put ideas into practice.	1	2	3	4	5
Team member can come up with new ideas, which can be realized.	1	2	3	4	5
Team members can produce new products, which meet market demand.	1	2	3	4	5
Team members can produce new products, which meet customer needs.	1	2	3	4	5

Environmental dynamism (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

The external environment of our company changes drastically	1	2	3	4	5
Customers often come up with new requirements for our products and services	1	2	3	4	5
The external environment is constantly changing	1	2	3	4	5
The number and variety of products (services) in our market are constantly changing.	1	2	3	4	5

Questionnaire

(Employee)

Dear Sirs/Madams,

We are conducting an academic research, and our research topic is the trigger factors of knowledge acquisition and its influence mechanism on team creativity. Thank you for your time to complete the questionnaire. Please read each question carefully, and answer these questions according to your experience. The questionnaire is only used for academic research, and we are assured of the anonymity of your responses. If the questionnaire is not completed or completed carelessly, it will affect the questionnaire quality of your whole team. Thank you for your help.

Basic information (please tick "√" or fill out relevant information at the horizontal line in accordance with your description)

(1)Your gender：Male ( ) Female ( )

(2)Your age： 25 and below ( ) 26-35 ( ) 36-45 ( ) 45 and above ( )

(3)Your tenure：3 years and below ( ) 3-10 years ( ) 11-20 years ( ) 20 years and above ( )

(4)Your educational level：Junior college or below ( ) Bachelor ( ) Master ( ) Doctor ( )

External knowledge search (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

Our team can search the required knowledge from a variety of channels (such as mediums and methods)	1	2	3	4	5
We search knowledge involving many fields, such as technology and manufacturing	1	2	3	4	5
Our team can deeply extract the required knowledge from what we searched.	1	2	3	4	5
Our team can take advantage of the knowledge that we have searched.	1	2	3	4	5

Knowledge sharing (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

I share my experience or know-how from work with members in this team frequently	1	2	3	4	5
I share my work reports and official documents with	1	2	3	4	5

members in this team frequently.					
I always provide my know-where or know-whom at the request of other team members.	1	2	3	4	5
I provide my manuals, methodologies and models for members of this team.	1	2	3	4	5
I share my expertise from my education or training with other team members.	1	2	3	4	5

Absorptive capacity (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

Our team has a strong ability to acquire relevant knowledge	1	2	3	4	5
Our team can grasp the opportunities from new external knowledge.	1	2	3	4	5
Our team has a strong ability to identify the value of diverse knowledge.	1	2	3	4	5
Our team can bring in new external knowledge quickly.	1	2	3	4	5
Our team can quickly analyze and interpret changing market demands.	1	2	3	4	5
My team members have the ability to absorb and comprehend new knowledge.	1	2	3	4	5
Our team quickly recognizes the usefulness of new external knowledge to existing knowledge.	1	2	3	4	5
Our team members have the ability to integrate new external knowledge and existing knowledge.	1	2	3	4	5
Our team refreshes its knowledge base quickly.	1	2	3	4	5
Our team has a strong ability to interpret existing knowledge into new ideas.	1	2	3	4	5
Our team can apply new knowledge to improve its work.	1	2	3	4	5
Our team can effectively exploit new knowledge to create new products, services, or work methods.	1	2	3	4	5
Our team can effectively provide new knowledge to employees.	1	2	3	4	5

Knowledge integration (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

Our team members analyze relevant information and knowledge according to the standard of work and procedure.	1	2	3	4	5
Our team members strictly follow the existing procedure to transfer professional knowledge and information	1	2	3	4	5
In our team, the processing of information, knowledge, and processes is highly computerized	1	2	3	4	5
Our team emphasizes knowledge combination with written rules and procedures.	1	2	3	4	5
In our team, the completion of products/projects requires the cooperation of team members.	1	2	3	4	5
Our team members can combine diverse knowledge and professional skills	1	2	3	4	5
Our team members can adjust themselves into other work in a short time.	1	2	3	4	5
When the times of training or job rotation increase, we may be more likely collaborate with each other.	1	2	3	4	5
When we need relevant knowledge, other team members will provide support for us in time.	1	2	3	4	5
Our team has a shared system and belief, which is identified by team members.	1	2	3	4	5
Team or organizational culture is highly identified by us.	1	2	3	4	5
Our team system needs to be discussed by all members.	1	2	3	4	5
We would like to accept our team's established system and culture.	1	2	3	4	5

Task interdependence (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=strongly disagree to 5= strongly agree)

I need information and advice from my colleagues to perform my job well.	1	2	3	4	5
I have a one-person job; it is not necessary for me to coordinate or cooperate with others.	1	2	3	4	5
I need to collaborate with my colleagues to perform my job well.	1	2	3	4	5
My colleagues need information and advice from me to perform their jobs well.	1	2	3	4	5

I regularly have to communicate with colleagues about work-related issues.	1	2	3	4	5

Task complexity (please tick "√" or fill out relevant information at the horizontal line in accordance with your description, ranging from 1=to a very little extent to 5= to a very high extent)

How much technical knowledge does the job in our team require?	1	2	3	4	5
To what extant do the jobs involve solving problems?	1	2	3	4	5
How much complicated are the jobs in our team.	1	2	3	4	5

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