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# Understanding innovation mechanism through the lens of communities of practice (COP)☆

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## ABSTRACT

A community of practice (COP) is an efficient and low cost route to promote innovation performance. However, there are few papers talking about the mechanism of the relationship between COP and innovation performance. Based on social capital theory, this paper analyzes the impacts that three dimensions of COP separately have on innovative performance through intermediary variables. We find relational capital and cognitive capital of COP have significant impact on innovation performance fully mediated by intellectual capital and psychological safety. Also structural capital of COP has positive influence on innovation performance partially mediated by intellectual capital and psychological safety. Finally, implications for companies are presented based on the findings.

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## 1. Introduction

In the rapidly changing and competitive worldwide market environment, enterprises need to promote innovation and improve creative capacity to gain competitive advantage, which requires these companies absorb and integrate various knowledge and skills. Thus, they need to build a comprehensive knowledge platform. However, for companies, especially small and medium ones, the main restriction is the enormous fixed cost of establishing a complicated and continuously updated knowledge platform. We suggest that enterprises should not ignore an effective but low cost platform of knowledge—communities of practice, under the circumstances that most enterprises are not able to afford their own knowledge exchange platform or manage knowledge effectively.

In simple terms, communities of practice can be understood as professional informal cooperation and communication networks. This organization phenomenon was first mentioned by Orr (1990). He found the Xerox customer service representatives' tips and tricks exchanged over breakfast or lunch can improve their professional working ability and performance significantly (Orr, 1990). Communities of practice spread individual tacit knowledge and transform it into organizational knowledge. They can also be called professional communities, as COP members tend to have a similar background and share professional experiences, skills, information, knowledge, and opinions together. Typical communities of practice include playwright community, game designers community, artist community, etc.

Communities of practice can bear most of the fixed costs incurred by production and accumulation of professional knowledge. In

communities of practice, members share experiences, skills, and explanations etc., all of which are the prerequisites to learn and create new knowledge. This kind of knowledge is not always covered by a traditional company's hierarchy and education. When enterprise requires constant innovation or creation of new knowledge, this system could make up for the drawbacks of traditional enterprise learning.

Till now, the researches on the function of communities of practice have reached consensus mainly in two aspects: (1) Communities of practice promotes knowledge sharing. It provides knowledge database and builds norms, trust and assessment in favor of knowledge sharing (Boland and Tenkasi, 1995; Pattinson and Preece, 2014 etc.); (2) Communities of practice improve the performance of individuals or organizations. It helps to promote the performance on the level of individual, group, and organization by reducing the learning curve, avoiding overlapping investment on new products and services, improving employees' working experience, and accumulating professional talents for the organization (Rongo, 2013; Chu et al., 2012, etc.).

The available literatures don't deny the positive role of communities of practice for innovation performance; for example, one reason for the performance improvement could be the COP's contribution on an enterprise's innovation. However, few studies have researched relations of COP and innovation. Thus this paper would mainly explore the role of COP on innovation and its operation mechanism.

## 2. Literature review and hypotheses

### 2.1. Communities of practice (COP) and social capital

The internal mechanism of communities of practice (COP) is the first thing to be settled. Members of COP contribute their explicit and implicit knowledge, put forward their own creative ideas in mutual

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communication, which may lead to losing their own competitive advantage especially in a knowledge concentrated industry. So the question is why members of COP don't refuse the knowledge sharing? Coleman (1990) suggests that the phenomenon of not taking a free ride in group is due to social capital (Coleman, 1990). It suggests that COP may help members to set up the social capital. Nahapiet and Ghoshal (1998) propose that social capital is easily to be built in the kind of group where members have common background and interacts frequently. Communities of practice exactly have these characteristics (Nahapiet and Ghoshal, 1998).

Lesser and Prusak (1999) further points out the three dimensions of the social capital in COP. (1) Structural dimension. Communities of practice improve the social network for personnel having the same interest. Communities of practice provide the opportunity for individuals to develop a network of individuals who have similar interests. It helps identifying those with relevant knowledge and helps individuals within the community make connections with one another. (2) Relational dimension. Communities of practice foster the sense of trust and obligations critical to building social capital through the interpersonal interactions. (3) Cognitive dimension. Communities of practice help shape the terminology, norms and values used by members and allow the development of a community memory in daily conversations.

Based on the above viewpoint, this paper proposes that the essence of COP is social capital. Based on social capital, COP members communicate and innovate effectively. Nahapiet and Ghoshal suggest that social capital can be used as a comprehensive system to understand the innovation problem (Nahapiet and Ghoshal, 1998). Therefore, in the discussion below, we will discuss the mechanism of COP's role on innovation based on the social capital theory.

## 2.2. COP and innovation

Under the mode of communities of practice, the innovation sources of enterprises mainly include three aspects:

1. Internal COP of enterprise. This process is usually subject to the strategy and requirements of the enterprise. It could be influenced and supervised by the formal procedure of enterprise. Internal COPs generally fall into two categorical types. One is community among professional staff from the same area that is often spontaneous through informal discussion. The other is the interaction of members in different areas. For instance, staffs from different areas take part in one project, build cognitive connections to complete the project and tend to bring the knowledge back to their own professional community through daily interaction. Gradually, members' knowledge is enriched, the gap between different professional communities is narrowed and thus the enterprise innovation and creative potential are increased.
2. COP outside the company (such as professional associations, exhibition, festival, etc.). Members in external COP communicate frequently and informally with members from other enterprises. They could make bold hypotheses, discuss over the rationality of ideas and gradually summarize the experiences of COP and record them. This process is not affected by the supervision of the company's formal procedures, is not necessarily consistent with corporate goals or strategy, and stays away from the pressure of enterprise management; therefore, the process could come up with good ideas due to its unstrained trait.
3. The interaction among diverse COPs. This leads to the innovation of "cross-border" or "industries integrating". In this way, members of the COP will communicate with the experts in other fields, customers, and even with competitors in the relevant areas to create new ideas, which will promote the innovation of the practitioners.

As we mentioned earlier, the operational basis of COP is social capital. Nahapiet and Ghoshal (1998) find that for organizations (such as communities of practice), using social capital to innovate is more

effective than simply relying on market exchange. Their framework, which integrates various facets of social capital into three dimensions—the structural dimension, the relational dimension and the cognitive dimension (Nahapiet and Ghoshal, 1998), is widely used by researchers. Scholars have analyzed and demonstrated the effect of social capital on innovation performance in these three dimensions of social capital. It has become the mainstream view that social capital has positive influence on innovation performance at different levels of team, big firms, SMEs, family-firms, community etc. (Hau and Kang, 2016; Sanchez-Famoso et al., 2014; Akçomak and TerWeel, 2009; Molina-Morales and Martínez-Fernández, 2010). Similarly, we infer the social capital in COP may promote innovation effectively. This leads to the first set of hypotheses.

**H1a.** Relational capital of COP has a positive effect on practitioner's innovation performance.

**H1b.** Structural capital of COP has a positive effect on practitioner's innovation performance.

**H1c.** Cognitive capital of COP has a positive effect on practitioner's innovation performance.

## 2.3. COP and individual intellectual capital

Intellectual capital is the individual's knowledge and competence that brings competitive advantage to the enterprise (Ramezan, 2011). As for the connotation of the intellectual capital, Mohan and Mark's (2005) three dimensions get the recognition of the majority of scholars. The three dimensions are human capital, relational capital and organization capital, which respectively refer to employee's knowledge and competence, key network relationship with stakeholders such as customers and suppliers, and supportive structures such as enterprise's database, institution, norm and procedure etc.

The participation of communities of practice can improve personal intellectual capital effectively (Ramezan, 2011). Social capital built by COP can significantly promote the integration of knowledge and improve member's personal intellectual capital. Based on internal social capital, COPs make effective knowledge combination and exchange, prompt the formation of new intellectual capital, and develop the mechanism of maximizing the intellectual capital (Nahapiet and Ghoshal, 1998).

By exchanging and integrating experiences, knowledge, and ideas, members of COP enrich and enhance their own ability, knowledge, and experience (human capital); better satisfy stakeholder's demands and improve the relationship between stakeholders (relational capital); and further strengthen enterprise's patent, trademark, copyright, knowledge base (organizational capital). This leads to the second set of hypotheses.

**H2a.** Relational capital of COP has a positive effect on practitioner's intellectual capital.

**H2b.** Structural capital of COP has a positive effect on practitioner's intellectual capital.

**H2c.** Cognitive capital of COP has a positive effect on practitioner's intellectual capital.

## 2.4. COP and individual psychological safety

Psychological safety refers to a kind of psychological atmosphere of mutual trust and support, that the team members believe the adventure is safe in the organization (Edmondson, 1999). In an environment of psychological safety, members think they won't incur embarrassment,

punishment or loss of interpersonal relationship due to mistakes, risks, and expression of true opinion.

In the informal and resource-based network like communities of practice, practitioners' development built on mutual trust, frequent interaction, mutually beneficial norms, and the process of effective innovation exchange can effectively improve their psychological safety. Firstly, from the perspective of group's characteristics, communities of practice are professional informal organizations, which are not restrained and pressed by the enterprises; Secondly, by the boundary scan, buffer and consolidation of communities of practice, it will form the cohesion, identity and commitment between the members (Faraj and Yan, 2009); Thirdly, increasing the communication frequency, trust and supportive relationships of communities of practice will enhance participants' psychological safety (Benn et al., 2013; Siemsen et al., 2009; Kahn, 1990, etc.). In conclusion, the informality, boundary, operational mode, and incurred communication and emotion of communities of practice will enhance the psychological safety of practitioners, so we propose:

**H3a.** Relational capital of COP has a positive effect on practitioner's psychological safety.

**H3b.** Structural capital of COP has a positive effect on practitioner's psychological safety.

**H3c.** Cognitive capital of COP has a positive effect on practitioner's psychological safety.

### 2.5. Intellectual capital, psychological safety and innovation performance

A number of studies have shown that intellectual capital significantly supports and influences innovation, the increase of intellectual capital can effectively improve individual and organizational innovation performance. For example, Hayton (2005) found that in the high-tech start-ups, human capital has a positive influence on innovation (Hayton, 2005). Subramaniam and Youndt (2005) showed that organizational intellectual capital could significantly affect organizational innovation performance. This leads to the fourth set of hypotheses.

**H4.** Practitioner's intellectual capital has a positive effect on practitioner's innovation performance.

Tang Yi (2004) confirmed that team's psychological safety improved team innovation by the intermediary effect of citizenship behavior (Yi, 2004). Team adaptation theory put forward that team's psychological safety enhances innovation by design, implementation plan and learning (Schulte et al., 2012). Kark and Carmeli (2009) also found that organizational psychological safety could effectively improve the staff's innovation participation (Kark and Carmeli, 2009). Specifically, the process of innovation is always unique or uncertain, the period of creating, building, cultivating and forming is usually long, the process of exploration and production is greatly risk-taking, In the safe psychological environment such as communities of practice which have no constraints

from enterprises, people are more willing to communicate and share their own knowledge and views with others, and generate more creative ideas and plans.

This leads to the fifth set of hypotheses.

**H5.** Practitioner's psychological safety has a positive effect on practitioner's innovation performance.

Fig. 1 presents the model of our hypotheses.

## 3. Method

### 3.1. Sample and sampling method

In order to explore the effect of COP on innovation, this study focuses on samples of creative and technology companies that have a higher requirement on innovation. The samples came from two sources. Some samples came from the random survey of practitioners working in Beijing's knowledge and creative industry zones, cultural enterprises or high-tech enterprises of Beijing, from which the research collected 194 valid questionnaires after excluding questionnaires of incomplete data and identical ratings from a total of 223 questionnaires. The other samples were collected by sending internet-based questionnaires to practitioners in cultural and high-tech enterprises outside Beijing, from which the research collected 131 effective questionnaires out of a total of 156 questionnaires.

To avoid incorrect inferences, there was a homogeneity test before merging the data of paper-based questionnaires and network-based questionnaires together. A chi-square test was taken on gender, marital status, education level and the average monthly income. Verification results show: chi-square values are 0.062, 0.616, 1.450, 0.062, *P* values are all >0.05, namely, gender, marital status, education level and the average monthly income from the two types of questionnaires are not different, so two kinds of questionnaires can be merged. There were 325 samples in total. Respondents were from the companies of software, culture, art, press and publication, radio and television, film, advertising, exhibition, art exchange, digital, multimedia, network industry and etc.

### 3.2. Measures

Based on the theoretical research, the questionnaire content scale design consists of seven parts: (1) demographic variables; (2) practitioner's innovation performance; (3) relational capital of communities of practice capital; (4) structural capital of communities of practice capital; (5) cognitive capital of communities of practice capital; (6) intellectual capital; (7) psychological safety. The survey measures were designed on the basis of existing mature scales. Measures of innovation performance were adapted from Xiuzhen et al. (2011), Lovelace et al. (2001). Measures of structural capital, relational capital and cognitive capital of COP were adapted from Nahapiet and Ghoshal (1998), Tsai and Ghoshal (1998). Measures of intellectual capital were adapted

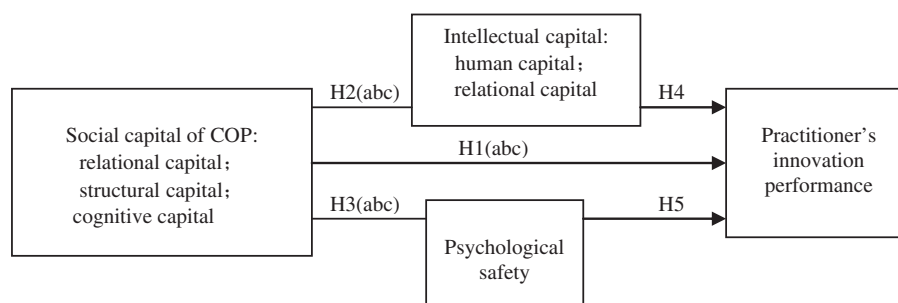


Fig. 1. The research model of this paper.

from Bontis (2001). Measures of psychological safety were adapted from Edmondson (1999).

After the preliminary scale design, we discussed the questions with related scholars and experts, visited creative, science and technology industrial clusters, and modified measures according to the interviewers' suggestions to ensure that each question is of semantic disambiguation, arranged reasonably and discriminately. Further, before applying the questionnaire to the practitioners, we conducted a pilot test of 50 samples. 50 pilot test samples were divided by the quantiles (27% and 73%) into high group and low group. By independent *t*-test, we retained questions that were significantly different in mean scores and discriminating.

This study adopted a seven point Likert scale for all dimensions. 7 point scale is used which is from strongly disagree to strongly agree for dimensions of cognitive capital, structural capital, relational capital, and psychological safety.

As this article cannot get the scale and intensity of the overall employees' participations in COP in the company level, but focuses on direct assessment of individual's participations in the communities of practice, the research of intellectual capital, psychological capital and innovation performance is also taken individual practitioners as objects.

As we can't obtain evaluations on individuals' intellectual capital and innovation performance from enterprises or third party, intellectual capital and innovation performance are measured by personal self-perception. Respondents were asked to compare the innovation capacity of their own company with their industry competitors. For the questions of intellectual capital and innovation performance, 1 in 7 point Likert scale means "is far lower than the average level", 7 "means far higher than the average level".

### 3.3. Research tool

This article builds the structural equation model, using SPSS20 and Amos 18.0 to data analysis and model validation.

## 4. Analysis of structural model

### 4.1. Confirmatory factor analysis

Confirmatory factor analysis (CFA) is an important step of SEM (Structural Equation Modeling). Thomopson (2004) suggests that before the analysis of the structural model, it should firstly testify whether

the model can correctly reflect the dimensions or not. This research made confirmatory factor analysis of the six dimensions (structural capital, relational capital, cognitive capital and psychological safety, intellectual capital, innovation performance) by turn, the loadings of all the dimensions are above 0.65, and are significant. The component reliabilities are all >0.7, the average variance extraction volumes are between 0.46 and 0.77 (as shown in Table 1), the result is in line with standard of Hair et al. (2009) and Fornell and Larcker (1981): (1) the load factor is >0.5; (2) reliability is >0.6; (3) the average variance extraction volume is >0.5; (4) the square of multiple correlation coefficient is >0.5.

Except for the dimension of psychological safety, the other dimensions all conform to the standard (as shown in Table 1). Psychological safety's square of the multiple correlation coefficient and average variance extraction volume are slightly lower than 0.5, however it's still within the acceptable range. So the six dimensions have convergent validity. Furthermore, the Cronbach's alpha coefficients of the 6 dimensions are 0.891, 0.853, 0.833, 0.773, 0.901, 0.889, which shows that the variables have good internal consistency reliability.

### 4.2. The fitness of the model

Fitness measures the degree of the consistency of expectation of covariance matrix and sample covariance matrix. The better the fitness is, the closer the model matrix is to the sample matrix. The good fitness of the model is the prerequisite of analysis of SEM. The fitness indicators of this study as shown in Table 2, are all consistent with ideal standard of fitness of SEM.

### 4.3. Structure model

The results of the analysis are depicted in Fig. 2. The standardized path coefficient and hypothesis testing results are shown in Table 3. SMC in Table 3 refers to the  $R^2$  of endogenous latent variable, which denotes the degree of interpretation of the independent variable X to dependent variable Y in the equation. Values of SMC (or  $R^2$ ) are between 0 and 1. The closer they are to 1, the stronger the explanatory power of the independent variable X to dependent variable Y. It is generally believed that when the  $R^2$  of endogenous latent variables is >0.67, the model has practical value; when the value is between 0.19 and 0.33, the model has provided moderate explanatory power; when the value is lower than 0.19, the model's explanatory power is weak.

**Table 1**  
Reliability analysis.

Dimension	Indicator	Non-std factor loading	S.E.	t-value	P	Std factor loading	SMC	CR	AVE
Structural capital	STR1	1				0.871	0.759	0.897	0.746
	STR2	1.061	0.05	21.067	***	0.958	0.918		
	STR3	0.857	0.052	16.395	***	0.748	0.56		
Relational capital	REL1	1				0.664	0.441	0.865	0.617
	REL2	1.35	0.109	12.365	***	0.827	0.684		
	REL3	1.517	0.122	12.46	***	0.837	0.701		
	REL4	1.393	0.115	12.101	***	0.801	0.642		
Cognitive capital	COG1	1				0.744	0.554	0.844	0.576
	COG3	0.999	0.078	12.797	***	0.758	0.575		
	COG4	1.165	0.084	13.864	***	0.858	0.736		
	COG5	0.963	0.086	11.211	***	0.663	0.44		
Psychological safety	PSY1	1				0.667	0.445	0.777	0.466
	PSY2	1.031	0.109	9.506	***	0.695	0.483		
	PSY3	1.167	0.12	9.73	***	0.731	0.534		
	PSY4	0.948	0.106	8.949	***	0.634	0.402		
Intellectual capital	INT4	1				0.873	0.762	0.907	0.766
	INT6	0.924	0.05	18.472	***	0.811	0.658		
	INT5	1.077	0.05	21.731	***	0.937	0.878		
Innovation performance	INNO1	1				0.742	0.551	0.892	0.735
	INNO2	1.236	0.076	16.202	***	0.947	0.897		
	INNO3	1.158	0.073	15.96	***	0.87	0.757		



**Table 2**  
The fitness of the model.

Fitness indicator	Ideal standard	Fitness of the model
Chi-square ( $\chi^2$ )	The less the better	277.791
$\chi^2/df$	<3	1.587
GFI	>0.9	0.926
AGFI	>0.9	0.902
RMSEA	<0.08	0.043
SRMR	<0.08	0.0402
TLI (NNFI)	>0.9	0.968
CFI	>0.9	0.974

In this article, values of SMC or  $R^2$  of innovation performance, psychological safety, and intellectual capital are 0.487, 0.542, and 0.238 respectively, which suggest the explanatory powers above the medium level. Thus overall explanatory powers of the model are acceptable.

4.4. Mediating effect of intellectual capital and safety environment

To further investigate whether capital and safety have a mediating effect, this study uses competition model to make a comparative analysis (Hair et al., 1995). Two groups of competition model are constructed for analysis. Competition model A is direct mode, which tests the relationship between the antecedent variables (social capital base of communities of practice) and outcome variable (innovation performance) directly. Competition model B is full mediation model, which tests the effect of antecedent variables (social capital of communities of practice) on outcome variable (innovation performance) via intermediary variables (intellectual capital and safety), without the direct path from antecedent variable to outcome variable. The results of the analysis are shown in Table 4.

According to the result of fitness shown in Table 4, chi-square test between the hypothesis model and competition model A (direct model) shows significant difference between the two ( $\Delta\chi^2 = 143.324$ ,  $\Delta df = 104$ ,  $P = 0.00676 < 0.01$ ). Chi-square test between hypothesis model and competition model B (full mediation model) also shows significant difference ( $\Delta\chi^2 = 34.47$ ,  $\Delta df = 3$ ,  $P < 0.001$ ). From the perspective of model fitness, hypothesis model is better than full mediation model, but competition model A is the best. However, as we know, the bigger the number of paths is, the more abundant the explanations are, and more difficult fitness indicators approach to the ideal value. Hypothesis model of this research has 11 paths, competition model A only has 3 paths, thus the hypothesis model constructs more paths, can provide more abundant explanations, and the degree of fitness of hypothesis model meets the ideal value, thus hypothesis model of this research is superior to the competition model of A and B.

Baron and Kenny (1986) pointed out that the intermediary variable was the third important variable that was inserted between independent variable and dependent variable to explain their relationship. The

full mediation effect means that the relationship between independent variable and dependent variable will become insignificant after inserting intermediary variable. The partial mediation effect means that the relationship between independent variable and dependent variable becomes weaker or less significant, after the intermediary variable is inserted.

The standard regression coefficients of the direct effect of three dimensions of social capital (without intermediary variable) on innovation performance are 0.278, 0.375, 0.173; and after intermediary variable is added, standard regression coefficients of the effect of two dimensions (relational capital, cognitive capital) on innovation performance become insignificant, and structure parameter of structural capital decreases to 0.306. It shows that intellectual capital and psychological safety play a fully mediating role in the effect of relational capital and cognitive capital on innovation performance, while they also play a partially mediating role in the effect of structural capital on innovation performance.

5. Conclusions and recommendations

5.1. The establishment of the research hypotheses

H1a has not proven that the effect of relational capital and cognitive capital on innovation performance is not significant, but in the main effect model, they are positively and significantly correlated to innovation performance (as shown in Table 4). It indicates that intellectual capital and psychological safety play a fully mediating role in the effect of relational capital and cognitive capital on innovation performance. The positive effect of structural capital on innovation performance has been proven, but after the intermediary variable is added, the original relationship has been weakened. It suggests that intellectual capital and psychological safety play a partially mediating role in the effect of structural capital on innovation performance.

The H2a of this research has been supported; it indicates that the social capital of COP plays a significant support role for practitioner's intellectual capital. In H3a of this research, the positive correlation of relational and structural capital and psychological safety has been proven, but the effect of cognitive capital on psychological safety has not been supported. H4 and H5 have been supported. It indicates that the intellectual capital and psychological safety play a significant support role for innovation performance.

5.2. Managerial implication

In simple terms, the research conclusion shows that the participation in professional COP plays a significant role in innovation performance. Meanwhile, intellectual capital and psychological safety have

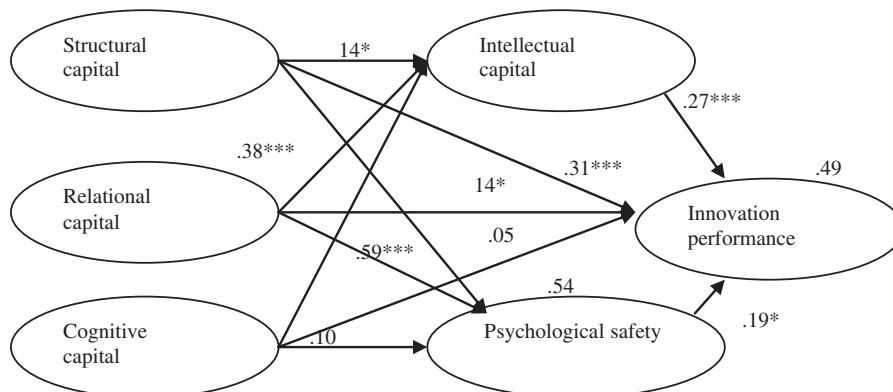


Fig. 2. The result of model fitness.

**Table 3**  
Innovation performance path coefficient and hypothesis testing.

Path		Hypotheses	Std. coefficient	P-value	Result	SMC		
Relational capital	→	Innovation performance	H1a	0.141	0.088	Nonsupport	0.487	
Structural capital	→	Innovation performance	H1b	0.306	***	Support		
Cognitive capital	→	Innovation performance	H1c	0.052	0.376	Nonsupport		
Intellectual capital	→	Innovation performance	H4	0.274	***	Support		
Psychological safety	→	Innovation performance	H5	0.187	*	Support		
Relational capital	→	Intellectual capital	H2a	0.198	*	Support		0.238
Structural capital	→	Intellectual capital	H2b	0.137	*	Support		
Cognitive capital	→	Intellectual capital	H2c	0.383	***	Support		
Relational capital	→	Psychological safety	H3a	0.593	***	Support		
Structural capital	→	Psychological safety	H3b	0.173	**	Support		
Cognitive capital	→	Psychological safety	H3c	0.101	0.095	Nonsupport		

\* P < 0.05.  
\*\* P < 0.01.  
\*\*\* P < 0.001.

partial a mediation effect in this process. The managerial implications are as follows:

- Enterprises should take advantage of informal knowledge system. Enterprises should make better use of COPs; combine it with the formal organization structure. Attaching importance to the intellectual function of COP does not mean that the enterprise does not need their own knowledge system. On the one hand, the active open system (communities of practice) can question and modify regular practice, create new ideas, and update knowledge and competence. On the other hand, organizations still need a traditional formal knowledge structure (such as laboratory, project team, etc.) to facilitate the absorption of knowledge from COP, practice ideas from COP, and interact with COP. Therefore, the ideal knowledge structure is formal and traditional knowledge structure (including the department of the enterprise, hierarchical management structure, the project organization) combined with informal knowledge structure (communities of practice).

How to cultivate soft knowledge structure? Of course, each enterprise has its certain preoccupation, some enterprises pay special attention on inner direct power, they develop their communities of practice by partly incorporating the communities into the inner enterprises; some other enterprises comprehensively rely on external power, their communities of practice are evolved to worldwide network. As for the cultivation of inner communities of practice, we believe that organizations should be adept at finding subsets which are oriented to common knowledge needs or interests and hobbies in the organizations, and which are the embryos of communities of practice. The identification of subsets should depend on the ken of communities of practice, the same ken as well as the interests and needs of the ken are the foundation and guarantee of the development of communities of practice. After the identification of the ken, organizations should implement various strategies of incentive and guidance, make opportunity for informal contacts and communications to pass on the best practice, and serve organizational strategy eventually. For instance, organizations specially arranged lunch-time communications among the

**Table 4**  
Comparisons between hypothesis model and competition model's fitness and loading.

Fitness indicator	Ideal standard	Hypothesis model	Direct model	Full mediation mode
Chi-square	The less the better	277.791	134.467	312.261
$\chi^2/df$	<3	1.587	1.894	1.754
GFI	>0.9	0.926	0.943	0.918
AGFI	>0.9	0.902	0.916	0.893
RMSEA	<0.08	0.043	0.053	0.048
SRMR	<0.08	0.0402	0.0394	0.053
TLI (NNFI)	>0.9	0.968	0.969	0.959
CFI	>0.9	0.974	0.976	0.966

Relation	ML estimate							
			Hypothesis model		Direct model		Full mediation	
			Std. coefficient	P	Std. coefficient	P	Std. coefficient	P
Innovation performance	←	Relational performance	0.141	0.088	0.278	***		
Innovation performance	←	Structural capital	0.306	**	0.375	***		
Innovation performance	←	Cognitive capital	0.052	0.376	0.173	**		
Innovation performance	←	Psychological safety	0.187	*			0.491	***
Innovation performance	←	Intellectual capital	0.274	***			0.336	***
Psychological safety	←	Relational capital	0.593	***			0.594	***
Psychological safety	←	Structural capital	0.173	**			0.224	***
Psychological safety	←	Cognitive capital	0.101	0.095			0.101	0.085
Intellectual capital	←	Relational capital	0.198	*			0.195	*
Intellectual capital	←	Structural capital	0.137	**			0.145	*
Intellectual capital	←	Cognitive capital	0.383	***			0.383	***

\* P < 0.05.  
\*\* P < 0.01.  
\*\*\* P < 0.001.

staff in the same ken to promote understanding of each other; and provided funds and infrastructure support for communities of practice.

As for enterprises' external communities of practice, on the one hand, enterprises should actively encourage their staff to participate in the activities of communities of practice (such as professional groups and professional activities and et al.); on the other hand, government should be committed to create favorable environment for innovative communication, and promote multi-layer interactive network and platform of knowledge, technology and industries by making and implementing effective industrial policies and incentives.

- (2) Companies should encourage and support their employees to participate COP.

The premise of exploiting COP is that the enterprises actively encourage and support staff to take part in the communities of practice, as well as create more informal contact, communicate and discuss opportunities among employees. In simple terms, practitioners should have “double identities”, not only doing the daily work from enterprise, but also taking part in interaction of COPs. Benefits include three aspects (Cohendet and Simon, 2008):

Firstly, it improves the industrial potential to innovate. As enterprise's employees, Members of COP would bring the different daily experience and knowledge to the communities, and in turn, take back other's knowledge. It could lead to innovation by the integration of different experiences, ideas and knowledge.

Secondly, it solves distance paradox. According to De Fillippi, the common way for companies to solve the dilemma between creativity and efficiency is normally by separating the creative department from daily managerial departments. By this way, production department keeps the efficient operation, while the creative department is able to think outside of the box. However, it may cause the “inconformity” problem; the creative ideas may face poor execution by the rest of the organization. Yet dual identity is the solution, because the company's employees are not only involved in the daily work of the project, but also participate in the creative process of the community of practice, therefore the “gap” will not be huge.

Thirdly, it helps taking advantage of the “micro creative”: “Micro creative” is the new ideas and creative suggestions which are created in the execution of projects by employees. It can make up the inflexibility and slow feedback of a formal organizational system. However, “micro creative” is always rejected or restricted, due to time pressure, immaturity and high cost. Under dual identities, “micro creative” could be improved and validated in the COP and eventually be accepted by the company. Further, “micro creative” will be also absorbed as a sort of knowledge and become creative ingredients to be used by projects of other members.

For staffs' effective participation in the communities of practice, enterprises can provide conditions for the staff to get more communities-of-practice-related social capital, for example, enterprises can encourage and fund the staff to take part in various forum sessions, scientific research cooperation and business communications and et al. Enterprises can also help the staff to improve their knowledge sharing ability of communities of practice, especially improve staff's knowledge absorptive ability to promote their innovative behaviors and ability.

- (3) Enterprises should also attach great importance to intellectual capital and psychological safety.

Intellectual capital and psychological safety also have positive effects on innovation performance, and play a role of

intermediary variable. Intellectual capital and psychological safety not only reveals the reason of the positive effect of COP on industry innovation performance, but also indicates that enterprises can use employees' intellectual capital and psychological safety to improve enterprises' innovation performance. For example, companies could improve the intellectual capital of enterprises by the means of strategic management; staff training; motivation and career development; cultivating collaborative environment (Carmona-Lavado and Cabello-Medina, 2013; Joshi et al., 2013, etc.). Also, the employees' psychological safety could be built by improving the interpersonal relationship quality, giving clear goals, providing information and resources to employees, adopting a supportive, open, flexible, and inclusive management style (Bendoly, 2014 etc.). By these means, the innovation competitiveness of enterprises can be enhanced directly or via an external driving force.

## 6. The limitations of this study and future research direction

We address limitations of this paper as follows. Firstly, the data of the paper mainly came from the creative industries; it needs to further testify whether the research conclusion could apply to the traditional industries. Secondly, the mechanism of this paper only introduced mediating effect, which may be too simple. Further study could further discuss the moderating effect in the process to better manifest the process.

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