

The Core Enterprise Network Competence, Network Characteristics and the Innovation Network Governance Performance – From Chinese Microcosmic Evidence

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ABSTRACT

To investigate the impact of the core enterprise network competence on innovation network governance performance, this paper introduces network characteristics as an intermediary variable and constructs a conceptual model according to the core enterprise network competence, the network characteristics and the governance performance of the innovation network. This paper also conducts empirical research using 543 survey data. The results show that network vision, network development, network relationship management and network combination management competences as well as network characteristics all have a positive impact on governance performance. Network characteristics have a partial mediating effect on the relationship among network development, network relationship management, and network combination management competences and governance performance; however, network characteristics have no significant mediating effect on the relationship between network vision competence and governance performance. This research will help Chinese enterprises better cultivate network competence and can provide a reference for the improvement of innovation network governance performance.

Keywords: core enterprise, network competence, network characteristics, governance performance

INTRODUCTION

With the implementation of China's national innovation-driven development strategy and the recent developments, the innovation network has become one of the key elements of the national innovation system. The innovation network is a basic system arrangement for system innovation; the main connection mechanism of network architecture is the innovation cooperation relationship between enterprises (Freeman, 1991). In reality, the innovation network often needs to overcome problems such as low efficiency and instability, and it needs effective network governance (Xinghua, 2015). Network governance performance is the degree of realization and the effect of the related goal of the entire network and each node. The different innovation subjects absorb each other's complementary resources, jointly address the risks, and create the total value during the continuous interaction time, that is, the size of the synergistic effect (Wei'an, 2014). The network governance performance is not only reflected in the independent nodes' performance; more importantly, it is reflected in the synergistic effect of the whole network. Currently, in China, the high failure rate and instability of the innovation network, network instability, a low-quality operation and a poor synergistic effect will seriously weaken the output of network innovation; therefore, how to improve network governance performance is a well worth studying.

Scholars have conducted useful explorations regarding how to improve the governance performance of innovation networks. Collis (1995) and Hagedoorn (2003) et al. argued that network competence affects the enterprise's behaviour, process and final status when the enterprise participates in network activities. Ritter (2004)

Contribution of this paper to the literature

- According to experience, to improve the cooperation process, we need to grasp the process and should observe the results. Therefore, we should systematically assess the performance of foreign exchange personnel and frequently evaluate the actual effect of the cooperation with partners.
- Around the whole network, collective strategic objectives construct the basic principles of innovation and cooperation in the network activities; establish the cooperative trading information platform; detect, evaluate and select innovation partners in a timely manner; take advantage of opportunities in the network; establish trust relationships with each partner; and create conflict resolution solutions under the context of interest games and then develop clear network action guidelines.

et al. constructed the model using the enterprise's business strategy as an antecedent variable of network and technical competences. The empirical study found that network competence had a significant positive impact on the innovation performance of network cooperation. Haucap (2012) found that node enterprises with stronger network competence can more effectively avoid conflict and then lay the foundation for the improvement of network governance performance. In China, Sha Zhenquan (2013) argued that the size of the enterprise network competence can affect not only the speed and quantity of various resources from the network but also the quality of the relationships among the network members and the stability of the whole network. Jian Zhaoquan (2014) conducted empirical research and suggested that network competence has a significant positive impact on service innovation performance. In network innovation activities, the core enterprise plays a leading and coordinated role. Because of the core enterprise's significant position and key role, the success of the network cannot be separated from the effective governance of the core enterprise.

In the innovation network, network members are in the multilateral relation net. Network governance must not only address the complex relationship between members but also integrate the objective of each node to the whole network goal (Yongping, 2012), which requires the core enterprise to have the appropriate network competence.

For the core enterprise, the enterprise with stronger network competence can better coordinate various relationships and achieve the overall interaction and collaboration of an innovation network through the network design (Pedersen, 2016). The relationship between the core enterprise and the partners will affect each other, some of which will promote each other; however, other relations may conflict with each other. Pedersen and Larsen (2006) particularly emphasized that the core enterprise as network manager needs to have the network ability to effectively integrate network resources. Therefore, the core enterprise must have a certain network competence to integrate the resource that exists in the network relationship, to better use the network resource and to improve the successful possibilities of the entire network innovation. Currently, the effect of the core enterprise network competence on the governance performance of the innovation network has been confirmed, but the impact effect of different dimensions of the core enterprise network competence on network governance performance remains controversial; the impact mechanism of both is not sufficient (Lo, 2016). Newbert et al. (2013) argued that the effective use of network competence requires the use of the network structure as a resource hub to therefore achieve leverage of the external innovation resources. Fang Gang (2001) argued that when the enterprise manages network activities, it is necessary to use the related competence to improve the network structure, the network relationship and other network forms to therefore enhance the performance. Zhang Baojian (2015) argued that network heterogeneity will provide a diversified combination of strategic solutions for enterprises with higher network competence and will rapidly expand performance improvement. Therefore, it is very meaningful to explore the role of network characteristics in the relationship between the core enterprise network competence and the innovation network governance performance.

RESEARCH HYPOTHESES AND CONCEPTUAL MODEL

Hypotheses

The core enterprise network capacity and the innovation network governance performance

Hakansson (1987) first proposed the concept of enterprise network competence; he suggested that the enterprise's network competence is the ability of enterprises to improve their network location and address a single relationship. The network vision competence is the strategic ability to manage the innovation network. Without this ability, it is difficult to find valuable innovation opportunities embedded in the network structure for the core enterprise (Möller, 2005). The network vision competence helps the core enterprise perceive and identify the potential cooperation opportunities and required resources (Tu, Tu, & Jhangr, 2016). With these innovative opportunities and information being discovered in time and better used, the core enterprise has improved the

degree of acquiring and controlling resources. In the practice of governance, the network vision competence promotes the core enterprise to cultivate the “preferred partner” reputation in the market, to attract more innovation subjects gathering, to interpret its own ideas and arrangements for its partners and to take advantage of the cooperation innovation between partners (Hakansson, 1987). It is conducive to the entire network to improve output innovation in order to achieve higher innovation network governance performance results. Accordingly, we hypothesize the following:

H1a: Network vision competence is positively related to innovative network governance performance.

Network construction competence is the competence that the core enterprise in the network can mobilize and coordinate the resources and activities of other actors, build and maintain the network, promote the network change and realize the value of the enterprise. The size of the network construction competence can affect not only the speed and quantity of various resources in the network but also the quality and stability of the relationship between enterprises (Zhaoquan, 2014). With this competence, the core enterprise can proactively conduct foreign exchange through arranging the resources and personnel and find and use the relationship promoters to build an effective network relationship (Daming, 2015). As positive contact occurs with each other, the core enterprises that have higher network construction competence will learn lessons constantly and efficiently and accumulate information and knowledge to further improve the cooperation process and improve the speed and accuracy of information transmission within the network. This process is conducive to enhancing innovation network governance process performance. Accordingly, we hypothesize the following:

H1b: The network construction competence is positively related to innovation network governance performance.

Network relationship management competence is competence that the enterprise aims at the relationship between specific organizations or groups to manage, establish, optimize and coordinate binary relations. This competence is the foundation of the other three abilities and is also the basic analysis unit of enterprise network competence. The network relationship management competence emphasizes deepening the relationship with each of the existing partners and maximizing the benefits from partners (Baojian, 2015). The core enterprise with stronger relationship management competence can re-evaluate the facts to establish the acceptable standards and procedures for the other party and construct the management model that can attempt to seek common ground and reserve differences with each member. This activity can reduce the negative conflict risk caused by the background culture and other factors and achieve results that satisfy both sides, therefore improving the innovation network governance process performance. Accordingly, we hypothesize the following:

H1c: Network relationship management competence is positively related to innovation network governance performance.

The network combination management competence is the competence that the enterprise aimed at different nature and form activities to coordinate and effectively integrate the multi-cooperation relationship. The relationship combination can have an important impact on the quantity and quality of the information when the enterprise obtains information. Stam et al. (2014) argued that the innovation output of innovation network requires the integration of heterogeneous innovation subjects and the integration of diverse innovation resources. The core enterprise with stronger combination management competence can be better at combining the various resources in the network and establishing the collective norms and shared value system between the members through appropriately strong connections to create synergies and ultimately improve the innovation network governance performance. Accordingly, we hypothesize the following:

H1d: Network combination management competence is positively related to innovation network governance performance.

The core enterprise network competence and network characteristics

Zeng Qinghui (2014) argued that network competence has a significant positive impact on the network structure dimension and the network relationship dimension (Qinghui and Guoshun, 2014). When the network competence is stronger, the core enterprise can better mobilize and coordinate the resources and activities of the network members, acquire knowledge and absorb cooperation experience. Through the control and coordination of the overall network, the core enterprise can better develop and execute a variety of network tasks and guide network changes. In this process, the core enterprise can obtain more information, realize technological changes, transmit the complementary knowledge and improve the accuracy of information (Bell, 2005). In the era of the rapid flow of knowledge, technology and information, network members need to obtain heterogeneous resources to compensate for their own shortcomings. The core enterprise is in the dominant position of the network. When the network competence is stronger, the core enterprise can effectively integrate the network resources, reconstruct the partners' relationship and build the heterogeneous network structure required by the network members. If a core enterprise with stronger network competence, it can also better evaluate the partners, avoid maintaining redundant

cooperation with those who can provide only less valuable information, further enrich the network relationship (Burt, 2010) and enhance the quality of the relationship and form a strong relationship connection with partners (Jianhong and Changzheng, 2013). Accordingly, we hypothesize the following:

- H2a:** Network vision is positively related to network characteristics.
- H2b:** Network construction competence is positively related to network characteristics.
- H2c:** Network relationship management competence is positively related to network characteristics.
- H2d:** Network combination management competence is positively related to network characteristics.

Network characteristics and innovation network governance performance

Network characteristics include relationship characteristic and structure characteristic such as network size, network intension, reciprocity, network heterogeneity, network density, network openness and network centrality. This paper draws on the mainstream view of Mitchell and Mitchell (1969), Xie Xuemei (2013) and other scholars in this field and selects the network size, network intensity, reciprocity and network heterogeneity to reflect the network characteristics.

As the basic feature of the innovation network, the difference of the network size will make the innovation network have different structure characteristics, which will affect the network governance performance of the enterprise (Xinghua and Bo, 2011). There are two views on the understanding of the network intension: one view (Deming et al., 2015; Coleman, 2008) argues that the strong connection can enhance the members' trust, reduce uncertain risk and then improve governance performance; another view (Burt, 2010; Xueyuan et al., 2016) argues that the non-redundancy of weak connection is helpful for the improvement of network governance performance. Currently, the academic mainstream view continues to argue that a strong connection is more favourable (Shenggang, 2010). The body of network cooperation can use the relationship of bilateral reciprocity and commitment and long-term repeated trading activities to coordinate thereby reducing transaction costs. Thus, the reciprocity can help reduce transaction costs, suppress opportunism and improve operational efficiency. The network of heterogeneity will enhance the interaction between the innovation subjects and then enhance the knowledge flow and resource allocation. When the degree of heterogeneity is higher, more ideas can be simulated to drive innovation through multiple paths. Accordingly, we hypothesize the following:

- H3:** Network characteristics are positively related to innovation network governance performance.

The mediating effect of network characteristics

The existing research has proven that to more effectively manage network activities, enterprises need network competence to help themselves optimize network structure relationship, location and other characteristics and thus achieve the purpose of performance improvement. Certain scholars regarded the network structure as a resource pipeline and emphasized its important role in the network competence performance impact process (Newbert, 2013; Zhang Baojian, 2015). Through empirical studies, other scholars further tested the intermediary role of network characteristics in the relationship between the network competence and performance (Sha Zhenquan, 2013; Zeng Qinghui, 2014). Stronger network competence enables the core enterprise to better identify opportunities and risks, construct new connections and enrich the network relationship. With the expansion of network size and the deepening of members' relationship, new technology knowledge and other resources are absorbed, and the degree of technological innovation is gradually increased. At the same time, the core enterprise can more easily establish trust and reciprocal connection with the members, optimize the network structure relationship and integrate and coordinate each side's resources. This will not only improve the utilization of network resources but also reduce the risk of conflict, and ultimately realize the improvement of the innovation network performance. In summary, the network characteristics play a mediating role between the core enterprise network competence and the realization of innovation network governance performance. Accordingly, we hypothesize the following:

- H4a:** Network characteristics play a mediating role between network vision competence and innovation network governance performance.
- H4b:** Network characteristics play a mediating role between network construction competence and innovation network governance performance.
- H4c:** Network characteristics play a mediating role between network relationship management competence and innovation network governance performance.
- H4d:** Network characteristics play a mediating role in network management competence and innovation network governance performance.

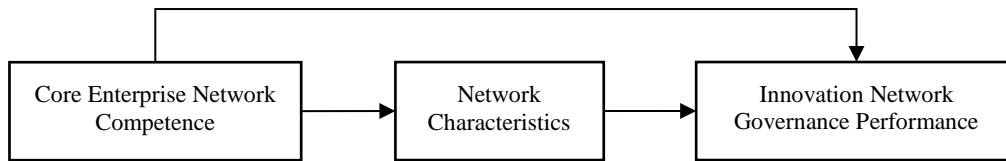


Figure 1. Model construction

Model Construction

In summary, the theoretical model of this paper is shown in Figure 1.

RESEARCH DESIGN

Sample Selection and Data Collection

In this study, we adopt a questionnaire to collect the data, and we purchase the paid sample service from a Chinese Internet company’s “Questionnaire Star” research platform to obtain the required questionnaire. To ensure the quality of the data, we strictly control channels and objects when issuing the questionnaire. We establish screening conditions before completing the questionnaires to ensure that the sample enterprises in the specific innovation network and that the sample enterprises the core enterprise in the network. The research subjects are middle and senior managers who are familiar with the whole situation of the enterprise. In total, we collected 587 questionnaires, including 44 invalid questionnaires and 543 valid questionnaires. The ratio of valid questionnaires is 92.5%. The basic situation of the sample enterprises is shown in Table 1.

The Variable Source and Measurement

To ensure the quality of the scale, we use the domestic and international authority maturity scale. After testing a small sample, we modify the scale properly and finally form a formal scale to collect the data for this study. In this paper, we use the Likert five-point scale by including 1 (totally nonconformity), 2 (comparison does not match), 3 (general), 4 (more consistent), and 5 (totally conformity).

For the measurement of the core enterprise network competence, we use Ren Shenggang (2011), Zhang Wei and Dang Xinghua (2011) and other scholars’ research for reference. The design includes 19 questions, 4 dimensions (network vision, network construction, network combination management and network relationship management competences) in the scale. For the network characteristics’ measurement, we use Xie Xuemei (2013) and others’ research as references. There are four aspects for measurement, including network size, network heterogeneity, network intensity and reciprocity. For the measurement of innovation network governance performance, we use Li Ling (2011) and Dang Xinghua (2011) and others’ scales for reference. There are ten questions included in the scale to measure innovative network governance performance from two dimensions: processes and results.

In this study, we select four variables (enterprise age, enterprise ownership, enterprise size and enterprise industry) as the control variables. The enterprise age affects the number of enterprise network connection; the older the enterprise is, the greater the number of enterprise network connection. Enterprise ownership affects the participation level of the enterprise market, and the operation efficiency is also different. In this paper, we use the number of enterprise personnel to reflect the enterprise size; the number of people influence the choice of enterprise innovation mode and cooperation form.

Multiple Regression Mathematical Model Construction

The innovation network governance performance is Y ; the network vision competence is X_1 ; the network construction competence is X_2 ; and the network combination management competence is X_3 . The network relationship management competence is X_4 ; and the network characteristic is M . The following regression equations can be used to describe the variables’ relationship:

$$Y = \beta_1 + c_1X_1 + c_2X_2 + c_3X_3 + c_4X_4 + \ell_1 \tag{1}$$

$$M = \beta_2 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + \ell_2 \tag{2}$$

Table 1. The basic situation statistics of the sample

Measurement index	Category	Number of samples	Proportional percentage (%)
Enterprise age	Less than 3 years	11	2.03
	Between 3 and 5 years	68	12.52
	Between 6 and 10 years	171	31.49
	Between 11 and 15 years	164	30.20
	More than 15 years	129	23.76
	In total	543	100
Enterprise ownership	Government enterprise	87	16.02
	Collective enterprise	33	6.08
	Private enterprise	346	63.72
	Foreign - funded enterprise	69	12.71
	Others	8	1.47
	In total	543	100
Enterprise size	Less than 20 people	12	2.21
	Between 20 and 100 people	102	18.79
	Between 100 and 300 people	178	32.78
	Between 300 and 1000 people	162	29.83
	More than 1000 people	89	16.39
	In total	543	100
Enterprise industry	IT industry	88	16.21
	Electronic and communication equipment industry	113	20.81
	Biopharmaceutical industry	55	10.13
	New Materials Industry	62	11.42
	Machinery manufacturing	120	22.10
	Chemical industry, textile industry	35	6.44
	Others	70	12.89
	In total	543	100

$$Y = \beta_3 + c'_1X_1 + c'_2X_2 + c'_3X_3 + c'_4X_4 + bM + \ell_3 \tag{3}$$

The coefficient c_i in equation (1) is the total effect of the independent variable X_i on the dependent variable Y . The coefficient a_i in equation (2) is the effect of the independent variable X_i on the mediating variable M ; the coefficient b in equation (3) is the effect of the mediating variable M on the dependent variable Y after controlling the influence of the independent variable X_i . The coefficient c'_i is the direct effect of the independent variable X_i on the dependent variable Y after controlling the influence of the mediating variable M ; β_i is the intercept term; and ℓ_i is the regression residual. In this model, the mediating effect is equal to the indirect effect that is the product of the coefficient $a_i b$; its relationship between the total effect and the direct effect is:

$$c_i = c'_i + a_i b \tag{4}$$

EMPIRICAL ANALYSIS

The Reliability and Validity Test

On the one hand, the variable measurement scale of this paper is based on the relevant questionnaires of domestic and foreign scholars. According to this study, we modify the scale moderately. On the other hand, we use Cronbach's Alpha coefficient of SPSS22.0 software to test the reliability and use KMO sample measure method and Bartley sphere test method to test the validity. The test results are shown in **Table 2**, indicating that the reliability and validity are appropriate.

Descriptive Statistics and Correlation Analysis

We use the SPSS22.0 tool to conduct descriptive statistics and correlation analysis. The quantitative values of the mean and standard deviation are consistent with the normal distribution. In general, the critical value of the relevant level exceeds 0.75, which is considered serious collinearity. From **Table 3**, we can observe that the

Table 2. Variable reliability and validity

Factor	Cronbach's Alpha	KMO	Bartlett
Network vision competence	0.704	0.745	0.000
Network construction competence	0.793	0.848	0.000
Network combination management competence	0.741	0.790	0.000
Network relationship management competence	0.724	0.745	0.000
Network characteristic	0.809	0.834	0.000
Innovation network governance performance	0.833	0.880	0.000
Entirety		0.933	0.000

Table 3. Descriptive statistics among variables and the Pearson correlation coefficient (N = 543)

Variables	Mean	SD	1	2	3	4	5	6
Network vision competence	4.08	0.54	1.000					
Network construction competence	4.07	0.53	0.520**	1.000				
Network combination management competence	4.02	0.54	0.482**	0.626**	1.000			
Network relationship management competence	4.09	0.56	0.502**	0.546**	0.546**	1.000		
Network characteristic	3.80	0.45	0.395**	0.529**	0.525**	0.459**	1.000	
governance performance	3.97	0.48	0.473**	0.615**	0.576**	0.587**	0.669**	1.000

Notes: *p < 0.05; **p < 0.01; ***p < 0.01.

Table 4. The core enterprise network competence, network characteristics and innovation network governance performance

Variables	Network characteristics		Innovation network governance performance			
	Model 4	Model 5	Model 1	Model 2	Model 3	Model 6
Enterprise age	0.041	0.012	0.037	-0.004	0.009	-0.009
Enterprise ownership	0.020	-0.010	0.027	-0.006	0.014	-0.002
Enterprise size	0.025	-0.008	0.065**	0.030	0.047**	0.033*
Enterprise industry	-0.017	-0.013	-0.020*	-0.014	-0.008	-0.009
Network vision competence		0.051		0.080**		0.059
Network construction competence		0.212***		0.253***		0.166***
Network combination management competence		0.215***		0.176***		0.088*
Network relationship management competence		0.118**		0.232***		0.183***
Network characteristic					0.696***	0.411***
F	5.851***	38.395***	5.851***	68.160***	91.805***	88.850***
R ²	0.042	0.365	0.042	0.505	0.461	0.600
Change in R ²	0.035	0.356	0.035	0.498	0.456	0.593
ΔR ²	0	0.343	0	0.463	0.419	0.558

Notes: *p < 0.05; **p < 0.01; ***p < 0.01.

correlation coefficient of each variable is less than 0.75 and has a correlation that indicates the distinction of the index design is suitable; thus, there is no collinearity question.

Regression Analysis

In this paper, we use the multiple regression analysis method and use SPSS22.0 software to verify the relevant hypotheses. We make the variables successive regression. **Table 4** shows regression results for the three relationships among the core enterprise network competence, network characteristics and innovation network governance performance.

- (1) The core enterprise network competence and innovation network governance performance. It can be observed from model 3 that when the enterprise age, enterprise ownership and enterprise size are control variables, the network vision competence, network construction competence, network combination management competence and network relationship management all have a significant positive effect on governance performance ($\beta=0.02, p<0.01$; $\beta=0.253, p<0.001$; $\beta=0.176, p<0.001$; $\beta=0.232, p<0.001$); thus, H1a, H1b, H1c and H1d were verified.
- (2) The core enterprise network competence and network characteristics. It can be observed from model 1 that the network vision has no significant positive effect on the network characteristics ($\beta=0.051, p>0.05$); therefore, H2a is not been verified. Network construction, network management, network relationship management competences all have a significant positive effect on network characteristics ($\beta=0.212, p<0.001$; $\beta=0.215, p<0.001$; $\beta=0.118, p<0.01$). Therefore, H2b, H2c and H2d are verified.

- (3) The network characteristics and innovation network governance performance. From model 4, we can observe that the network characteristics positively affect governance performance ($\beta=0.696$, $p<0.001$). Therefore, H3 is verified.
- (4) The mediating effect of network characteristics. The four dimensions of the core enterprise network competence in model 3 have a significant positive impact on innovation network governance performance, such as network vision, network construction, network combination management and network relationship management competences. In model 5, network construction, network combination management and network relationship management competences all have a significant positive impact on the network characteristics. However, the regression coefficient is not significant ($\beta=0.051$, $p>0.05$) between the network vision competence and network characteristics, which indicates that network characteristics do not play a mediating role in the impact relationship of the network vision competence on innovation network governance performance; therefore, H4a has not been verified. In model 6, we conduct regression analysis on the innovation network governance performance when the four dimensions of the core enterprise network competence and the network characteristics all are independent variables. The network characteristics have a significant positive impact on the innovation network governance performance ($\beta=0.411$, $P<0.001$), which means that network characteristics plays a mediating role in the impact relationship of the network construction, network combination management and network relationship management competences on innovation network governance performance. Network construction, network combination management and network relationship management competences have a significant positive impact on the innovation network governance performance, and the impact of the main effect becomes weak; therefore, network characteristics play a partial mediating role in the impact relationship of network construction, network combination management and network relationship management competences on innovation network governance performance.

EMPIRICAL STUDY RESULTS AND MANAGEMENT IMPLICATIONS

Empirical Study Results

Based on the conceptual model construction of core enterprise network competence, network characteristics and innovation network governance performance, according to the questionnaire data of 543 Chinese enterprises, we test the impact effect of the different dimensions of the core enterprise network competence on the network governance performance and the mediating effect of network characteristics. The empirical results show the following:

First, the different dimensions of the core enterprise network competence have different effects on innovation network governance performance. First, the network vision, network construction, network combination management and network relationship management competences have a significant positive impact on governance performance, which means that enhancing these four network competences can improve the innovation network governance performance. Among these competences, the impact of network construction competence on innovation network governance performance is most significant, which may be because network construction competence reflects the competence that the core enterprise controls the whole network competence from the micro-enterprise to the macro- enterprise. Stronger network competence enables the core enterprises to better manage the innovation network on both macro and micro levels, promote the synergistic effect of the whole network and improve the innovation network governance performance. It also allows the core enterprise to better evaluate future development and changes in the network and enables the enterprises to effectively take appropriate action in advance to governing; the stronger the network relationship management competence, the more effective the core enterprise can manage the binary relationship with its partners. When the core enterprise benefits, the partners will also benefit, which lays the foundation of the core enterprise to better manage the entire network, and when the network combination management competence is stronger, the core enterprise can better control the multiple relationships among partners and integrate the objective of each network member, making it coherent and reducing the occurrence of conflicts and the opportunistic behaviour. The improvement of these network competences is helpful for the superior development of an innovation network and for more efficient technological innovation, thus creating shared value and improving innovation network governance performance.

Second, the different dimensions of the core enterprise network competence have different effects on the network characteristics. First, network construction, network combination management and network relationship management competences all have a significant positive impact on the network characteristics, which shows that enhancing these three network competences can help optimize the network structure and improve the network relationship. Among these competences, the network combination management competence has the most significant impact on the network characteristics, which may be due to network management competence. This competence can coordinate and effectively integrate multiple partnerships to help enterprises establish the

collective norms between partners and the shared value system. The core enterprise is based on the advantage of its own network location; it can use the network combination management competence to manage the differences between rules and reduce the negative impact from cooperation between both sides because of different organizational backgrounds and cultures. This finding is conducive to improving the reputation reciprocity and trust between partners, and it has a positive impact on the network characteristics. Second, the impact of the network vision competence on the network characteristics is not obvious. The probable reason is that the network vision competence is a type of strategic network competence, and the operation relationship with the specific network activities is not direct; therefore, the impact of the network vision competence on the network characteristics is not obvious.

Third, the network characteristics play a partial mediating role in the relationship among the network construction, network combination management, and network relationship management competences and innovation network governance performance; this shows that the impact of network construction, network relationship management and network combination management competences on innovation network management performance is transmitted through the network characteristics to a certain extent. Cultivating and using the network competence can lead to effective network construction and affect the network characteristics, thereby enhancing the innovation network governance performance. This paper argues that the reason of the mediating effect in the relationship between core enterprise network competence and innovation network governance performance may be the interoperability of the innovation network and the synergy of network governance performance. Further, the connotation of the core enterprise network competence is analysed: on the one hand, network construction competence, network relationship management competence and network combination management competence are all types of dynamic competences that can help the core enterprise take the initiative to control, construct and manage binary or multi-relationship to absorb lacked heterogeneous resources and affect network changes. On the other hand, the network innovation activity is embedded in the member's relationship pattern or structure. Therefore, the network construction competence, network relationship management competence and network combination management competence have not only a direct effect on the innovation network governance performance but also promote network characteristics through the effective network construction to influence the innovation activities among the members to achieve the goal of improving the innovation network governance performance.

The network construction competence may have a positive impact on the network size and the network heterogeneity. By influencing the number and type of members in the network, the abundance of the whole network resources can be improved, which will affect the innovation network governance performance. The network relationship management competence and network combination management competence may have a positive impact on network intensity and reciprocity. Deepening and integrating binary and pluralistic partnerships, improving the quality of relationships among network members, and achieving closer cooperation with less conflict can enhance the innovation network governance performance. The enhancement of these three competences has a significant positive effect on the network size, network heterogeneity, network intensity and reciprocity as well as other characteristics. The positive changes of these network characteristics further affect the innovation network governance performance.

Management Implications

Innovation network governance performance can reflect the overall state of the innovation network. The core enterprise as the leader of the innovation network, the impact on the different dimensions of its network competence, and the innovation network governance performance and its influence mechanism are also an academic focus. According to the research results, we obtain the following management implications; we hope these findings can provide a reference for the improvement of the innovation network governance performance.

Firstly, the impact of the network construction competence on innovation network governance performance is very significant; therefore, the core enterprise should further strengthen the construction of network construction competence. In China, it is more important to construct and maintain the relationship. The core enterprise can actively contact potential partners with relational resources by collaborating to gain more new partners and access new and diverse information. At the same time, we should establish an open and flexible organizational culture, timely adjust behaviours and strategies, guide and coordinate the work for foreign exchange personnel, meet the needs of partners and create valuable new opportunities. According to experience, to improve the cooperation process, we need to grasp the process and should observe the results. Therefore, we should systematically assess the performance of foreign exchange personnel and frequently evaluate the actual effect of the cooperation with partners.

Secondly, although the mediating effect of network characteristics between network vision competence and innovation network governance performance is not verified, the network construction, network relationship management and network combination management competences have great influence on innovation network

governance performance. Therefore, the mediating effect of network characteristics cannot be ignored in promoting the innovation network governance performance. Actively constructing an effective network structure, enriching the network relationship and forming the resource pipeline, it is helpful to highlight the mediating effect of the network characteristics and more effectively transmit the impact of the network competence on the innovation network governance performance. The core enterprise should ignore short-term effects in the network governance process. Around the whole network, collective strategic objectives construct the basic principles of innovation and cooperation in the network activities; establish the cooperative trading information platform; detect, evaluate and select innovation partners in a timely manner; take advantage of opportunities in the network; establish trust relationships with each partner; and create conflict resolution solutions under the context of interest games and then develop clear network action guidelines.

CONCLUSIONS

In this paper, we construct the conceptual model of the core enterprise network, the network characteristics and the innovation network governance performance and conduct an empirical test based on the questionnaire data of 543 Chinese enterprises. The research results show that network vision, network construction, network combination management and network relationship management competences are each positively related to network governance performance. The network characteristics are positively related to the innovation network governance performance and have a partial mediating effect on the relationship of the network construction, network combination management, and network relationship management competences and network governance performance.

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