Study on the Relationship between Innovation Openness and Knowledge Management in Network

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Abstract—Innovation has always been a hot topic in the management circles. Now in the fierce market competition, a single organization becomes more and more dependent on external resources, especially knowledge resources, for innovation. The importance of knowledge Management in network has been more and more widely recognized as network organization, which has become an effective form of access to external resources. This paper summarizes knowledge management in network from knowledge integration and knowledge acquisition. This article also analysis the relation between knowledge management in network and innovation openness empirically by collecting data with questionnaire survey and using regression analysis method with the help of SPSS. Researchers find that knowledge acquisition has an intermediary role in innovation openness and knowledge integration. The study can deepen the understanding about the mechanism of innovation openness and knowledge management in network, provide some suggestions to solve the issues, and improve innovation performance in the organization.

Keywords-Innovation Openness; Network Organization; Knowledge Management; Knowledge Acquisition; Knowledge Integration

I. INTRODUCTION

In recent years, many studies have realized the importance of external knowledge sources on innovative processes, enterprises may tend to cooperate with external organizations. Laursen and Salte carried out the relevant research, put forward the concept of openness, and believed that openness could be divided into open breadth and open depth. Breadth refers to the type and quantity of open external knowledge sources in the innovation process; and depth is the extent of using of external knowledge sources in the innovation process [1]. Based on theoretical and empirical research by previous, Lazzarotti and Manzini proposed two ways to measure openness, one was the type and number of partners outside the enterprise, the other one was the type and number of innovation process opening to the external. Wu Yan-ni, a Chinese scholar, defined and enriched the measure of "openness" from the perspective of relations and process. Openness can be divided into the openness of relationship and process.

The openness of relationship indicates the frequency of cooperation between business with customers, competitors, suppliers, government agencies, technology agency and other external resources; while the openness of process represents the frequency of cooperation with external in the innovation process[2].

With the development of new technologies, the interrelated and interdependent network relationship between multiple organizations appear which make a number of organizations closely linked with business activities. Accordingly, knowledge management within the enterprise should be developed into the acquisition and integration of knowledge between organizations. In this study, knowledge acquisition is process of turning the explicit knowledge and tacit knowledge into searchable and re-use of knowledge [3]. While knowledge integration is process of integrating and refining knowledge resources on the internal and external network organizations, systematizing the individual knowledge or internalizing the knowledge into the mental system of members in the organization [4].

In this context, researchers fully study the existing paper, divide knowledge management in the network organization into knowledge acquisition and knowledge integration, and examine the relationship between innovation openness, knowledge integration and knowledge acquisition which enrich the theoretical model and provide theoretical guidance and practical advice to adjust and improve knowledge management activities in network organization for enterprise.

II. HYPOTHESES AND THEORETICAL MODELS

A. Hypotheses of innovation openness and knowledge acquisition

In the open innovation model, a distinctive feature of openness is to ask the companies to fully utilize external innovation resources, access to support from the outside. In view of this, in order to obtain complementary or heterogeneity resources outside the organization, innovation activities should be paid more attention to the using of openness[5]. In addition, a higher degree of openness helps broaden the channels of inter-organizational knowledge acquisition, open culture can accelerate technical cooperation and information sharing between organizations, so that knowledge exchange, sharing, configuration and integration can be achieved[6].

In general, in the open innovation model, companies can accelerate the flow of knowledge which is widely distributed outside the enterprise by improve openness, so that knowledge can be transferred to an external organization or be absorbed into the organization through a variety of ways. Therefore, openness reflects the knowledge transfer and absorption which is conducive to knowledge acquisition undertaken.

Based on the above analysis, the study proposes the following hypotheses:

H1: innovation openness has significant positive effect on knowledge acquisition.

H1a: Open breadth has a significant positive effect on knowledge acquisition.

H1b: Open depth has a significant positive effect on knowledge acquisition.

B. Hypotheses of knowledge acquisition and knowledge integration

If knowledge management can be understood as a continuous process, the knowledge acquisition and knowledge integration is the key and the closely linked two-step process. Knowledge acquisition is the prerequisite of knowledge integration, only the knowledge of other individuals or organizations expressed, the enterprises can go on further integration. Knowledge Integration represents the process of component knowledge getting into structural knowledge[7]. In the knowledge integration process, the more knowledge the company owned, the easier for the company to express by a common language, thus contributing to the integration of knowledge[8]. Therefore, only after fully and continuously accessing to knowledge, understanding the knowledge of other individuals, researchers can sort out a reasonable link between knowledge, so that employees are more convenient and easier to understand and summarize new knowledge, improving the absorption and integration ability.

Based on the above analysis, the study proposes the following hypotheses:

H2: knowledge acquisition has a significant positive impact on knowledge integration.

C. Hypotheses about the intermediary role of knowledge acquisition between the innovation openness and knowledge integration

The key of knowledge integration is interaction and cooperation. Interaction emphasizes the interactive application between two individuals, while cooperation emphasis individual concentration creation. The higher openness, the easier for enterprise to understand the characteristics, views and communication of network partners which can facilitate consulting new issues, new ideas, while the problems in the integration process can be coordinated which create good conditions for integrating knowledge and achieving new ideas. Communication plays an important role in knowledge integration and organizational learning, mutual learning between the members of the organization is the key to the realization of knowledge integration[8]. Moreover, willingness to cooperation with body of knowledge is the factor that influences the knowledge integration. More often cooperation between enterprises, more easy to understand each other, which can help reach a consistent goal, reduce the frequency and intensity of conflicts, increase the obligations that are assumed to improve the efficiency of cross organizational knowledge integration. Improving the level of cooperation, to strengthen the connection between enterprises, can provide the necessary commitment to promote interaction and cooperation, and strong connections contribute to the integration of knowledge, both of which have a complementary role [9].

Based on the above analysis, the study proposes the following hypotheses:

H3: Knowledge acquisition has an intermediary role to innovation openness and knowledge integration.

H3a: Knowledge acquisition has an intermediary role to open breadth and knowledge integration.

H3b: Knowledge acquisition has an intermediary role to open depth and knowledge integration.

D. Theoretical Model

Through the study of the network organization the connotation of knowledge management and innovation openness, relationships, research model established in this paper as shown:

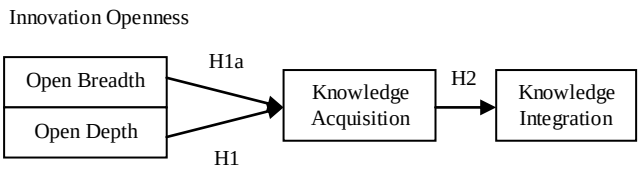

Figure 1. The theoretical model of this research.

III. RESEARCH DESIGN AND EMPIRICAL ANALYSIS

A. Scale Construction

a. Knowledge Management in Network Organization

Many scholars have studied on knowledge acquisition and knowledge integration. This article mainly combines with the scale from lane (2001) [10] and Zhu Xiao-qin (2011) [11], and forms a scale of knowledge management in network organization, as shown in Table 1.

TABLE I. THE SCALE OF NETWORK ORGANIZATION KNOWLEDGE MANAGEMENT

Variable	No.	Measurement items
Knowledge Integration	a1	Enterprises can effectively integrate the newly acquired knowledge and the original accumulation of knowledge together
	a2	Enterprises can effectively integrate the knowledge acquired from different sources
	a3	Enterprises can effectively integrate knowledge into different technologies or applications
	a4	Enterprises can effectively integrate the knowledge of different enterprises, groups or individuals in the target task level
	a5	Enterprises can be based on the need to bring together the experts from various departments and enterprises

	a6	Enterprises can effectively adjust the external network
Knowledge Acquisition	b1	Knowledge of new technology is obtained from the network
	b2	Knowledge from the network to obtain a lot of new markets
	b3	Knowledge of product development is obtained from the network
	b4	Knowledge of management skills are acquired from the network
	b5	Knowledge of manufacturing processes is obtained from the network

b. Innovation and opening degree

Researchers combine with researches of Laursen, Salter (2006) [1] and Chen Yu-fen, Chen Jin [12], select 10 external partners (leading users, mainstream users, suppliers, competitors, industry, enterprises, universities or research institutions, technology intermediaries, venture capital enterprises and government departments) to allow the respondents scored their cooperation frequency. In measuring the breadth (c1), the score of 1 is 0 points, the rests record as 1 point, and then sum of 10 external partners; in measuring depth (c2), the score less than 4 records as 0, greater than or equal to 4 is 1, and then sum of 10 external partners.

B. Sample collection

This study conducted a questionnaire survey in Shanghai by individual ability, involving chemical, automotive, electronics, food, machinery, textiles, construction and other traditional manufacturing industries, transportation, trade, consulting, banking, finance, catering, retail and other services, as well as the software industry, bio pharmaceutical, new materials industry and other high-tech industries.

The questionnaire is distributed in 400 copies, 288 of them are returned, so the recovery rate is 72%. The effective questionnaire is 248, and the effective rate is 62%. The effective sample is shown in the following table.

TABLE II. THE BASIC SITUATION OF THE SAMPLE

Type		Sample number
Industry type	Traditional manufacturing	92
	Services	108
	High-tech Industry	48
Ownership	State-owned enterprises	60
	Private Enterprise	72
	Foreign companies	88
	Joint ventures	28
Employee number	1-15	16
	16-50	16
	51-100	20
	101-500	68
	501 and above	128

As can be seen from the above table, the measured samples covering different industry types, different ownership, different company sizes, have good universality.

C. Validity and reliability analysis

In order to ensure the quality of the measurement results, researchers need to test the reliability of the sample data. This paper uses Cronbach analysis which is commonly used in Richter quantitative reliability test method. From the following table, researchers can see that all factors of the Cronbach internal consistency coefficient is more than 0.6, which shows that the degree of consistency of the questionnaire survey is higher, and the internal structure is good, it can be accepted.

TABLE III. COEFFICIENT OF CRONBACH' S α

Factor name	Knowledge Integration	Knowledge Acquisition
Coefficient of α	0.847	0.856
The number of questions	6	5

In this paper, researchers analyze the results of measurement index about 5 knowledge acquisition and 6 knowledge integration by EFA, use principal component analysis to extract the common factor, and get the value of each load factor by the method of varimax orthogonal rotation method.

KMO values are 0.779 and 0.775, and Sig are all 0. researchers reject the null hypothesis that the correlation matrix is the unit matrix. Researchers can find the total variance is 57.328% and 63.454%, from the Variance Explained Total table, and the corresponding load of each index is more than 0.5, which indicates that the questionnaire has good construct validity.

TABLE IV. THE FACTOR LOADINGS OF MEASUREMENT ITEMS

Variable	Num.	Factor loading
Knowledge Management	a1	.855
	a2	.853
	a3	.781
	a4	.723
	a5	.714
	a6	.581
Knowledge Acquisition	b1	.822
	b2	.813
	b3	.811
	b4	.770
	b5	.765

D. Correlation analysis

Correlation analysis is a quantitative analysis method to analyze the relationship between objective things. On the basis of the reliability and validity of the questionnaire, this paper used the Pearson method to analyze the correlation between variables.

TABLE V. THE CORRELATION TABLE OF MEASUREMENT ITEMS

Variable		Knowledge Integration	Knowledge Acquisition
Innovation Openness	Pearson correlation	.396**	.529**
	Sig(2-tailed)	.001	.000
Open breadth	Pearson correlation	.298*	.481**
	Sig(2-tailed)	.019	.000
Open depth	Pearson correlation	.374**	.413**
	Sig(2-tailed)	.003	.001
Knowledge Integration	Pearson correlation		.667**
	Sig(2-tailed)		.000

The above table shows that, in addition to the correlation between open breadth and knowledge integration variable is at 0.05 significance level, the other is at the 0.01 significance level, and the Pearson correlation is less than 0.8, so there is no linear problem. The correlation of knowledge acquisition and knowledge integration is the largest of all, 0.667, positive, which proves hypothesis 2. The correlation coefficients of the innovation openness, opening width, open depth with knowledge acquisition are 0.529, 0.481, 0.413, so hypothesis 1, 1b and 1a are verified.

E. Regression Analysis

Regression analysis is widely used in the empirical study for the quantitative relationship. It focuses on the study of the variation of the number of variables, and then describes the relationship in the form of regression equation, which helps the researcher to learn the influence of one or more variables. In this paper, the following table is taken by a one-time regression method:

TABLE VI. THE TABLE OF REGRESSION COEFFICIENTS

	Modle1 a		Modle2 b		Modle3 a	
	β	T	β	T	β	T
Series 1						
c	0.396	3.341	0.529	4.826	0.060	0.530
b					0.635	5.565
R2	0.143		0.268		0.428	
F	11.164		23.294		23.853	
Series 2						
c1	0.298	2.417	0.481	4.253	0.030	0.270
b					0.681	6.156
R2	0.074		0.219		0.426	
F	5.844		18.085		23.666	
Series 3						
c2	0.374	3.128	0.413	3.510	0.120	1.136
b					0.617	5.857
R2	0.126		0.156		0.438	
F	9.785		12.317		24.762	

In model 1, innovative openness (c), opening breadth (c1), open depth (c2) has a significantly positive impact on the knowledge integration (a); in model 2, innovative openness (c), open breadth (c1), open depth (c2) have a significantly positive impact knowledge acquisition (b); in model 3, researchers take knowledge integration (a) as the dependent variable, innovative openness (c), open breadth (c1), open depth (c2), respectively together with knowledge acquisition (b) as the independent variables, and find β value of innovation openness, open breadth and open depth is 0.06, 0.03 and 0.12, which is less than the corresponding β value in model 1 and not significant. While the β value of knowledge acquisition is still significant. Therefore, the results indicate that knowledge acquisition has a fully intermediary role to innovation openness and knowledge integration and assuming 3,3a, 3b are verified.

IV. CONCLUSION

This paper empirically studies the relationship between the innovation openness and knowledge management in the network organization, but it is different from most of the knowledge management within the enterprise, the article is concerned on the knowledge management between enterprises. What's more, it is also different from some studies which take knowledge acquisition and integration as a whole concept, This study distinguishes the two concepts, and get the knowledge acquisition and knowledge integration into the research field, The influence of innovation openness on the two is discussed in depth, and the following conclusions are obtained: (1) Innovation openness has a significantly positive effect on knowledge acquisition; (2) knowledge acquisition has a significantly positive impact on knowledge integration; (3) knowledge acquisition has a fully intermediary role to innovation openness and knowledge integration. So first, this requires that enterprises should fully aware of the importance of innovation and openness, improve openness breadth and the depth conditionally. This is conducive to the effective use of knowledge resources in the external organization; Second, enterprises should pay particular attention to access and exchange of knowledge and information in the integration of external knowledge resources, just simply improve innovation openness cannot play the desired results.

This article also has some shortcomings. For example, the companies also pay special attention to the protection of knowledge in knowledge management, business itself may release some of their knowledge resources, and some companies will be directly authorized by outside business research and innovation which are not covered in this article; Meanwhile, in the follow-up study, researchers can expand the sample data and the geographical scope, so as to further verify the conclusion of the universal.

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