*International Journal of Business and Management Invention (IJBMI)*
*ISSN (Online): 2319-8028, ISSN (Print):2319-801X*
*www.ijbmi.org || Volume 9 Issue 7 Ser. III || July 2020 || PP 17-23*

# The influence of network centrality on enterprise innovation ability-Regulating effect of tacit knowledge transformation

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***ABSTRACT:****Under the background of industrial structure transformation, the innovation ability of enterprises is related to whether an enterprise can develop healthily and rank among the top. The position of enterprises in network structure is the key factor affecting their resource acquisition ability.The transformation and application of tacit knowledge is a key link for enterprises to improve their core competitive advantages and realize value increment.Based on the relationship between network centrality and the innovation ability of enterprises, this paper explores the influence of network centrality on the innovation ability of enterprises and examines the moderating effect of the transformation of tacit knowledge.The results show that network centrality has a significant positive effect on the enhancement of enterprise innovation ability, which provides new suggestions for enterprises to improve their innovation ability.*

***KEY WORD****: Network centrality，Tacit knowledge transformation，Enterprise innovation ability*

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Date of Submission: 14-07-2020 Date of Acceptance: 29-07-2020

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## I. INTRODUCTION AND LITERATURE REVIEW

For a long time, innovation has been an important way for enterprises to improve their self-innovation ability and achieve strategic goals.Technological innovation refers to the process of creating and applying new knowledge to develop new technologies, new processes, new products and new services [1].Technological innovation occupies a dominant position in China's high-tech enterprises, which is a process of using knowledge to creatively combine existing technologies and resources and generate new knowledge [2].Current studies mainly discuss the effect of network centrality on enterprise performance.There is a lack of consideration of how network centrality improves the innovation ability of enterprises.The moderating effect of the transformation of invisible knowledge is even less studied.This paper explores the influence of network centrality on the innovation ability of enterprises and provides reference for them to improve their innovation ability, which has certain theoretical and practical significance for guiding the practice of enterprise cooperation network construction and management.Powell,Koput, Smith Doerr L et al. (1996) believe that enterprises in the center of the network can more easily control innovation-related information and resources [3].Tsai(2001) proved in his study that the position of nodes in the network and the absorption capacity of nodes play an important role in knowledge transfer and knowledge innovation, that more related individuals have more opportunities to have access to external knowledge, and that nodes in the central position can control the flow of knowledge among groups [4].

### 1.2 Network centrality and enterprise innovation ability

Network centrality of an enterprise refers to the degree to which the enterprise is located in the center of the network, which represents the importance of the enterprise in the system and also means the influence of the enterprise on network resources [5].Sanou et al. pointed out that network centrality improves the competitive power of enterprises, thus improving their innovation ability [6].Enterprise innovation generally includes exploratory innovation and utilization innovation [7].The former is based on their own past experience to explore innovation, the latter is the use of self-cognition innovation.Taking a central position in the network reflects the following aspects for enterprises to improve their innovation ability:

#### 1.2.1 Access to information and knowledge

The central enterprise has more information and knowledge, which greatly helps the enterprise to access resources and information.On the one hand, from the perspective of the interconnecting distance between all members of the network, the sum of paths between the central enterprise and other members of the network is the shortest, so the centrality of the network improves the enterprise's ability to obtain information in the network.On the other hand, the enterprise at the center of the network is usually in the shortest path of information exchange between other members of the network.The central enterprise not only has the advantage of information resources, but also is the only channel for information exchange among other members of the

network, which will help the central enterprise to maximize the use of information and knowledge, so as to improve its innovation ability [8].

### 1.2.2 Control of resources

Enterprises in the center have more resources than those in the periphery, which provides great help to improve their innovation ability [9].At the same time the center of the enterprise to make it have more relative power, which makes the edge to center enterprise produced dependence, the key technology of enterprises have had to be attached to the center, thus promoting the knowledge exchange center and edge of enterprises information, so that the central enterprises have more rights to resources.For enterprises to provide more technology, market opportunities, help to improve the innovation ability of enterprises.

### 1.2.3 Deliver influential signals in the network

A company at the center can signal that it has an important influence in the industry, which will attract more new entrants to form partnerships with it.Because the enterprise is located at the centre of the special position and has rich information resources, so the central enterprises to make measures will greatly influence the other enterprise network, and even affect the development of enterprise, for this is enterprise in the network, to catch the signal from the central enterprises may make their own better development, and for new into the enterprise network, the signal is more important, will give the development direction of new enterprises to provide a reliable to get a better development, which is closely connected with central enterprises have the central link, it has a strong geographical resources, political resources, social network resources.

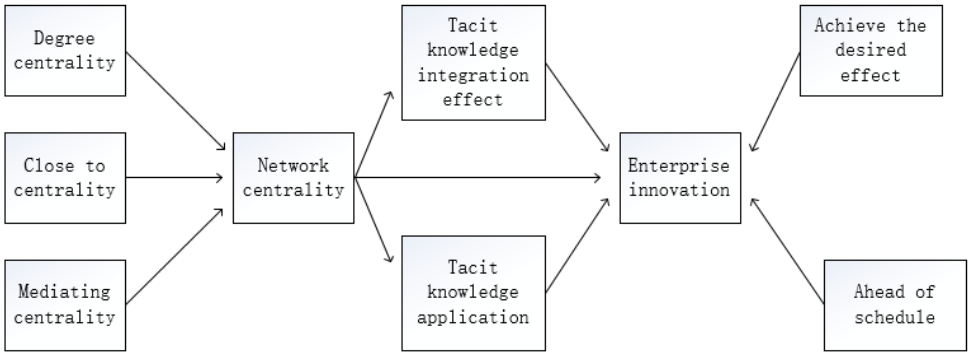
## 1.3 Transformation of tacit knowledge

The application of tacit knowledge is a key link for enterprises to improve their core competitive advantages and realize value increment.Because of the complexity and particularity of tacit knowledge, it is only by successfully transforming tacit knowledge into explicit knowledge that can be shared and utilized that tacit knowledge can be transformed into creativity.Because the recessive knowledge that can be used directly is very few, therefore, should pay attention to improve the efficiency of recessive knowledge transformation.Improving the efficiency of tacit knowledge transformation is conducive to increasing core competitive advantages of enterprises and promoting technological and production process innovation of enterprises [10].

## 1.4 Theoretical Model

This paper summarizes the centrality of the network to the ultimate purpose of enterprise innovation ability.Explore network centricity for enterprise innovation ability, the influence of specific performance for network centricity due to the special advantages of can directly affect tacit knowledge conversion capability, and tacit knowledge conversion capability can effectively improve the innovation ability of enterprises, at the same time, the network centricity to improve enterprise innovation ability also have a direct impact, so the tacit knowledge conversion capability to improve the innovation ability of enterprises play a regulatory role.(See Figure 1)

**Figure 1: Conceptual model of network centrality affecting enterprise innovation capability**




### 1.4.1 Measurement index of network centrality [11]

**Degree centrality**:Degree centrality is a measure of how central the company is in the network.In the digraph of social network, degree centrality includes extroversion centrality and introversion centrality. Among them, extroversion centrality refers to the sum of the number of external relations acknowledged by a node enterprise. The formula is as follows:

$$C_{DO}(n_i) = do(n_i) = \sum_{j=1} X_{ij}$$

Standardized formula: $$C'_{DO} = \frac{d_o(n_i)}{g-1}$$ :Where $X_{ij}$ value is 0 or 1, which represents whether actor i recognizes the relationship with actor j, and g refers to the number of people in the network.

Whereas inward centrality refers to the sum of the number of relationships that other nodes admit to a node, and its formula is as follows:

$$C_{DI}(n_i) = d_I(n_i) = \sum_{j=1} X_{ji}$$

Standardized formula: $$C'_{DI} = \frac{d_I(n_i)}{g-1}$$ : Where $X_{ji}$ value is 0 or 1, which represents whether actor j recognizes the relationship with actor i, and g refers to the number of people in the network.

**Close to centrality**:Proximity centrality is the relative distance in the network to calculate the degree of centrality of a node. The closer the node is to other enterprises in the network, the higher the degree of centrality is; the farther the node is from other enterprises in the network, the lower the degree of centrality is. The calculation formula is as follows:

$$C_c(n_i) = \left[\sum_{j=1}^{g} d(n_i, n_j)\right]^{-1}$$

In the formula, $d(n_i, n_j)$ is the distance between $n_i$ and $n_j$, $C_c(n_i)$ is the sum of the distances from node $n_i$ to each of the other nodes, The smaller the value, the greater the distance between $n_i$ and other points. Thus, the more marginal an individual or organization is, the less important its position is. And vice versa.

**Mediation centrality**:Mediating centrality measures the ability of an individual or organization to act as a mediator, acting as a potential mediator for other actors in the network, and finally bringing intermediary benefits to them.Its calculation formula is as follows:

$$C_B(n_i) = \frac{\sum_{j<k} g_{jk}(n_i)}{g_{jk}}$$

Standardized formula:

$$C'_B(n_i) = \frac{\sum_{j<k} g_{jk}(n_i) \Big/ g_{jk}}{(g-1)(g-2)}$$

Where $g_{jk}$ is the shortcut number of actor j to actor k, $g_{jk}(n_i)$ is the shortcut number of actor i in the shortcut number of actor j to actor k, and g is the number of people in this network.

The formula of group mediation:

$$C_B = \frac{2\sum_{i=1}^{g}\left[C_B(n^*) - C_B(n_i)\right]}{\left[(g-1)^2(g-2)\right]}$$

### 1.4.2 Theoretical Assumptions

**H1**:There is a significant positive correlation between the centrality of the network and the innovation ability of the enterprise

**H2**:There is a significant positive correlation between the centrality of the network and the transformation of tacit knowledge

**H3**:There is a significant positive correlation between the transformation of tacit knowledge and the innovation ability of enterprises

**H4**:Tacit knowledge transformation plays a moderating role between network centrality and enterprise innovation ability

**1.5Research Model**

**1.5.1 Definition and measurement of variables**

**Definition and measurement of network centrality**

Network centrality mainly includes the following three aspects to explore the impact on the innovation ability of enterprises: high degree centrality, high proximity centrality and high intermediary centrality [12].

**(1)**: Definition and measurement of tacit knowledge transformation

The effect of tacit knowledge transformation on the innovation ability of enterprisesis explored by the integration effect of tacit knowledge and the comprehensive application of tacit knowledge.

**(2)**: The definition and measurement of enterprise innovation ability

In this paper, the innovation ability of enterprises is reflected in the following two aspects: the new services developed by enterprises can achieve the expected results of customers and the company can complete the new service projects ahead of time.

**1.5.2 Research Samples**

In this paper, the three variables of 20 enterprises were measured by likert subscale, in which "1= totally disagree", "2= relatively disagree", "3= uncertain", "4= relatively agree" and "5= completely agree" [13].

**1.6 Empirical Research**

**1.6.1 Reliability Analysis of samples[14]**

Cronbach's Alpha coefficient was used to measure and test the reliability of the collected sample data. As shown in the following table:

**Table 1: Reliability analysis of variables**

| Name of scale | item | Alpha coefficient |
|---|---|---|
| The whole table | 7 | 0.962 |
| Network centrality | 3 | 0.873 |
| Tacit knowledge transformation | 2 | 0.889 |
| The innovation ability of enterprises | 2 | 0.869 |

It can be seen that the three variables in this study, namely network centrality, tacit knowledge transformation and enterprise innovation ability, all meet the statistical requirements, indicating that the design samples in this paper have a good structure and high credibility.

**1.6.2 Validity analysis of samples[15]**

The structural validity of the test scale mainly uses the following two indicators: KMO value test and Bartlett's sphericity test. The results are shown in the following table:

**Table 2: The KMO sample measure and the chi-square value of Bartlett's Sphere test**

| Name of scale | KMO value | Bartlett's sphericity test approximates chi-square | df | Sig |
|---|---|---|---|---|
| The whole table | 0.747 | 195.473 | 21 | 0.000 |
| Network centrality | 0.682 | 28.906 | 3 | 0.000 |
| Tacit knowledge transformation | 0.500 | 20.052 | 1 | 0.000 |
| The innovation ability of enterprises | 0.500 | 15.897 | 1 | 0.000 |

*** means significant at 0.01 level, and * means significant at 0.05 level*

As shown in Table 2, KMO and Bartlett's sphericity test were performed on variables. KMO values of all three variables were greater than or equal to 0.5, and significance level P of Bartlett's sphericity test of the three variables was 0.000, less than 0.01, indicating that the obtained data could be analyzed by factors.

### 1.6.3 Correlation analysis

**Table 3: Correlation analysis between network centrality and innovation capability of enterprises**

| Correlation coefficient and significance | Achieve the desired effect | Finish the project ahead of schedule |
|---|---|---|
| Degree centrality | 0.889** | 0.841** |
| Close to centrality | 0.895** | 0.682** |
| Mediating centrality | 0.810** | 0.832** |

*** means significant at 0.01 level, and * means significant at 0.05 level*

It can be seen from Table 3 that there is a significant positive correlation between the centrality of the network and the innovation ability of the enterprise, that is, the centrality of the network is conducive to improving the innovation ability of the company. Hypothesis 1 is verified.

**Table 4: Correlation analysis between network centrality and transformation of tacit knowledge**

| Correlation coefficient and significance | Tacit knowledge integration effect | The use of tacit knowledge |
|---|---|---|
| Degree centrality | 0.945** | 0.727** |
| Close to centrality | 0.854** | 0.788** |
| Mediating centrality | 0.818** | 0.612** |

*** means significant at 0.01 level, and * means significant at 0.05 level*

Table 4 shows that there is a significant positive correlation between the centrality of the network and the transformation of tacit knowledge, that is, the centrality of the network is conducive to the transformation of tacit knowledge. Hypothesis 2 is proved.

**Table 5: Correlation analysis between transformation of tacit knowledge and innovation ability of enterprises**

| Correlation coefficient and significance | Achieve the desired effect | Finish the project ahead of schedule |
|---|---|---|
| Tacit knowledge integration effect | 0.919** | 0.926** |
| The use of tacit knowledge | 0.735** | 0.791** |

*** means significant at 0.01 level, and * means significant at 0.05 level*

It can be seen from Table 5 that there is a significant positive correlation between the transformation of tacit knowledge and the innovation ability of enterprises, that is, the transformation of tacit knowledge is conducive to improving the innovation ability of enterprises. Hypothesis 3 is verified.

In this paper, multiple linear regression method is used to test the moderating effect of tacit knowledge transformation on the innovation ability of enterprises.Baron & Kenny's research pointed out that a variable can be considered as having a regulating effect when it meets the following four conditions :(1) there is a significant correlation between independent variables and dependent variables;(2) Significant correlation between independent variables and regulatory variables;(3) Significant correlation between regulating variables and dependent variables;(4) After adding the moderator variable into the regression model of the relationship between independent variable and dependent variable, the moderator variable has a significant effect on the dependent variable, while the independent variable's effect on the dependent variable weakens or completely disappears.

Table 3 shows a significant correlation between independent variables and dependent variables. As shown in Table 4, there is a significant correlation between the self-scalar and the moderator variable. Table 5 shows

that there is a significant correlation between regulating variables and dependent variables. That satisfies the first three conditions. The results of multiple regression analysis using SPSS are shown in the following table:

**Table 6: Multiple regression analysis table**

| variable | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Degree centrality | 0.552** | 0.409* | 0.527* | 0.466* |
| Close to centrality | 0.129** | 0.123* | -0.010* | 0.012* |
| Mediating centrality | 0.170** | -0.013* | 0.197* | 0.108* |
| Tacit knowledge integration effect | | 0.398** | | 0.297** |
| The use of tacit knowledge | | | 0.361** | 0.182** |

*** means significant at 0.01 level, and * means significant at 0.05 level*

It can be seen from model 1 that independent variables are significantly positively correlated with dependent variables.After adding the moderator variable "tacit knowledge integration effect" into model 2, the correlation coefficient of the three independent variables decreased, indicating that the correlation between independent variables and dependent variables weakened.In model 3, the moderator variable "application of tacit knowledge" was added. The correlation coefficient of the first two independent variables decreased, indicating that the correlation between independent variables and dependent variables weakened.In model 4, "tacit knowledge integration effect" and "tacit knowledge application" were added at the same time. The correlation coefficient of the three independent variables decreased, indicating that the correlation between independent variables and dependent variables weakened, that is, hypothesis 4 was verified.

### 1.7 Conclusions and Suggestions

At first, this paper verifies the network centricity, conversion of tacit knowledge, the interaction relationship between enterprise's innovation ability, the network centricity from centricity "degree", "close to the central", "intermediary centricity" three aspects to discuss, and then from the "tacit knowledge integration effect", the use of "tacit knowledge" two dimensions to measure the transformation of tacit knowledge, verify the conversion of tacit knowledge in the network centrality and adjust action between enterprise's innovation ability, it is concluded that the network centricity to enterprise's innovation capability has a significant role in promoting.

**Conclusion 1:The network centrality of an enterprise is positively correlated with its innovation ability.**

Compared with enterprises on the edge of the network, enterprises located in the center of the network can obtain richer knowledge resources and information, because enterprises with high network centrality hold more resources. At the same time, enterprises at the center of the network, while actively maintaining their central position, should pay attention to maintain good cooperative relations with other member enterprises in the network, create an atmosphere of trust and openness, and strengthen exchanges and communication between enterprises. Through knowledge sharing, more relevant knowledge and technology can be acquired, so as to improve the innovation ability of enterprises.

**Conclusion 2: Tacit knowledge transformation plays a moderating role between network centrality and enterprise innovation ability, among which the moderating effect of tacit knowledge integration is the most significant.**

Enterprises should improve their tacit knowledge transformation ability. Actively build corporate culture, improve staff's learning enthusiasm. Tacit knowledge is a complex and important resource, so enterprises should strengthen their awareness of its importance and make full use of tacit knowledge resources.

## BIBLIOGRAPHY

[1]. Li Shouwei. Research on the Influence of Knowledge Transfer on Enterprise innovation Ability -- The Moderating Effect of Network Centrality [J]. Science and Technology Management Research, 2008,38(18):164-171.
[2]. SPENDER J C. Makingg knowledge the basis of a dynamic theory of the firm [J].Strategic Management Journal,1996(17):45-62.
[3]. Powell W W, Koput K W, Smith Doerr L. Inter-organizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology [J]. Administrative Science Quarterly, 1996,132(41).
[4]. Tsai W, Ghoshal S. Social Capital and Value Creation: The Role of Intra-firm Networks [J]. Academy of Management Journal, 1998,(41).

[5]. Wang Xingxiu, Kang Liqun. Influence of Competitive Network Location on enterprise innovation Ability -- Based on empirical Analysis of Listed Automobile Manufacturing Companies [J]. Science and Technology, 2012,31(05):6-10.
[6]. SANOU F H, ROY F L, GNYAWALI D R. How Does Centrality in Coopetition Networks Matter? An Empirical Investigation in the Mobile Telephone Industry [J]. British Journal of Management,2016,27(1):143-160.
[7]. JANSEN J J P, VAN D B F A J, VOLBERDA H W. Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators [J].Management Science,2006,52(11):1661-1674.
[8]. Wang Yonggui, Liu Fei. Research on the Influence of Network centrality on Enterprise Performance -- The Moderating Effect of Innovation Correlation, Political correlation and Technological uncertainty [J/OL]. Economic and Management Research :1-15[2019-05-16].
[9]. Chen Yitong, DONG Zhengying. Inverted U-shaped Relationship between Enterprise Network Centrality and Performance -- Intermediary role of Entrepreneurship Orientation and Regulatory role of environmental uncertainty [J]. Science and Technology Management Research, 2008,38(12):192-204.
[10]. Geng Ye, DING Yuanyuan. The Path of Innovation Network Organization influencing enterprise value appreciation: From the perspective of Knowledge Capital [J]. Finance & Accounting Communication,2019(11):82-85.
[11]. BI Xiaoping. Research on the Relationship between network centrality, knowledge innovation ability and KIBS Innovation Performance [D]. Central South University,2012.
[12]. Zhang Xuan, Wang Guo-shun, BI Xiao-ping. Influence of Network centrality and knowledge innovation ability on innovation Performance [J]. Economic Issues,2013(08):92-96.
[13]. Tao Juying. Empirical Research on Enterprise Network Centrality and Technological Innovation Performance -- Mediating Effect of Organizational Learning Ability [J]. Market Weekly (Theoretical Research),2013(06):147-150.
[14]. Zhang c m, wan c h, Yang c, huang z w, wu b, xu c. reliability analysis of outcomes scale for patients with coronary heart disease [J]. Chinese general practice,2019,22(11):1350-1354.
[15]. Li Guobing, TIAN Yaping. Comparison and Validity Analysis of Regional Tourism Resource Competitiveness in The Pearl River Delta [J/OL]. Economic Geography :1-14[2019-05-16].

Zhang Yali. "The influence of network centrality on enterprise innovation ability-Regulating effect of tacit knowledge transformation." *International Journal of Business and Management Invention (IJBMI)*, vol. 09(07), 2020, pp. 17-23. Journal DOI- 10.35629/8028