

## **The influence of the number and diversity of partners in the network alliance on the technological diversity of enterprises**

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**ABSTRACT:** *With the economic globalization, the increase of uncertain factors in the market, the competitiveness of enterprises has also increased, enterprises want to survive in the complex network, must make full use of network advantage, break the constraints that hinder the development of enterprises, and continue to innovate to achieve technological diversity to ensure their own competitiveness. There are many factors that affect the technological diversity of enterprises in network alliances, such as network centrality, resource integration capabilities, and partners. Based on the previous literature, this paper studies the relationship between the number and diversity of partners in the network alliance on the technological diversity of enterprises. The results show that there is a positive correlation between corporate technological diversity and the number and diversity of partners. Therefore, if enterprises want to realize technological diversity, they must actively realize alliances in the network, and cooperate with more companies in different fields.*

**KEY WORD:** *Network alliance; Enterprise technology diversity; The number and diversity of partners*

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Date of Submission: 20-08-2020

Date of Acceptance: 05-09-2020

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### **I. INTRODUCTION**

The diversity of enterprise technology is considered to be the key to the continuous realization of the development of emerging technologies for enterprises<sup>[1]</sup>. The diversity of technology can provide multiple solutions for the development of enterprise products. It increases the opportunities for product reorganization and innovation. When the market environment changes, companies will have more autonomous choices in technology. New technologies are jointly developed by participants in different fields, and these participants cooperate through the network. Few companies can independently develop new technologies and innovate internally. The success of an enterprise often requires cooperation between individuals and organizations. Network alliances are considered to be a key issue in the innovation system. The network is too weak and may inhibit knowledge sharing, while the network is too strong, which may lead to inability to focus, which is not conducive to innovation<sup>[2]</sup>. In the management literature, there are many studies on innovation networks, and social networks are used to explain the innovation performance of enterprises<sup>[3]</sup>. These studies can promote the research of innovation systems to better understand network elements. Network alliances effectively aggregate resources from multiple parties and are an important source of enterprise innovation to achieve technological diversity. Research cooperation among various participants in the technological innovation system is also becoming more and more common, such as cooperation between large companies, SMEs and knowledge institutions. Enterprises can improve technological innovation through knowledge sharing and mutual cooperation, and realize technological diversification. By connecting companies in different fields, they can acquire knowledge from complementary companies, suppliers, and industry associations. By acquiring new knowledge through these channels, companies can promote their own technology, management, and product innovation activities, and improve competitiveness. Therefore, there is an inseparable relationship between the realization of technological diversity of enterprises and the internal and external networks of enterprises. Nowadays, more and more management scholars and economists have joined the ranks of network alliance research. In the network alliance, the position of the enterprise in the network and whether the enterprise can occupy the central advantage in the network is the key to whether the enterprise can win in the fiercely competitive market; how the enterprise's ability to integrate network resources can be better utilized the knowledge and resources in the network to deal with risks; the number and diversity of the company's partners, whether the company is in contact with partners in different fields, such as the government, universities, etc. The government will formulate relevant policies and implement subsidies to promote technology development and Innovation. As an effective platform for enterprises to obtain resources and share knowledge, deeply analyze the influence of the number and diversity of partners in the alliance network on the technological diversity of enterprises, which helps to clarify how enterprises can gain a more favorable position in the alliance network, and effectively coordinate the relationship with other partner companies in the network.

## **II. Concept introduction**

### **2.1 Enterprise technology diversity**

The realization of technological diversity in enterprises can support enterprises to effectively carry out product innovation and improve market competitiveness. Therefore, more and more scholars pay attention to technological diversity in enterprises. Enterprise technological diversity has gradually become the research field of enterprise managers and scholars from various countries.

#### **2.1.1 The concept and role of enterprise technological diversity**

With the continuous development of science and technology, companies are also facing various uncertainties in market competition. In order to avoid risks caused by such uncertainties, companies are increasingly adopting diversified strategies based on technological diversity. Technological diversity of an enterprise means that a company has developed technologies in other fields in addition to its core technical capabilities. First of all, the realization of technological diversification by enterprises helps to choose alternatives and avoids falling into the dilemma of only one technology. If companies have too little technology, they will lose the opportunity to find better alternatives, thereby reducing the competitiveness of the product. Secondly, technological diversity increases opportunities for reorganization and innovation, which means it is conducive to the development of new technologies. Third, technological diversity enhances the ability of enterprises to adapt to sudden environmental changes, and this change is more significant in the embryonic stage of the product cycle<sup>[4]</sup>. Technological diversity provides flexibility and increases the ways to deal with risks. However, some scholars believe that corporate technology diversity will reduce concentration and cannot concentrate on the development of core technologies. However, in reality, companies will always maintain a high level of concentration on major technologies to ensure their core competition, and also develop diverse technologies.

#### **2.1.2 Enterprise technological diversity characteristics**

With the development of the times, the products and R&D of enterprises have shown a trend of "diversity", and a large number of multi-technology enterprises have emerged. These companies have similar characteristics in achieving technological diversity. Enterprise technological diversity is carried out on the basis of existing knowledge and resources, and enterprise R&D or acquisition of new technology usually has some correlation with its existing resources. The association of seed delivery makes the diversity of technology continue to evolve. Therefore, the diversity of technology is the continuous and gradual progress of existing knowledge and resources, rather than a product that suddenly appears<sup>[5]</sup>. The technological fields involved in enterprises are often problematic, so technological diversity is closely related to the partners of enterprises. In addition, for different companies, there is also a correlation between corporate technology diversity and product diversity. However, technological diversity also has disadvantages. It will hinder the creation of standards and large-scale economies. Similarly, companies in order to choose different technological alternatives will cause more coordination and integration costs.

### **2.2 Network alliance**

The rapid development of the Internet makes all aspects of people's lives inseparable from the Internet. The relationship between the Internet and innovation has become a current research focus. Many studies have proposed that the Internet is a necessary prerequisite for innovation<sup>[6]</sup>. An alliance is a voluntary agreement reached between various enterprises to obtain benefits to realize the sharing of knowledge, technology and other resources, and the network is a network of relationships formed by the alliance enterprises. Some enterprises realize network alliances based on common goals and some based on obtaining resources. Liu Yi believes that the members of the alliance network can come from all over the world, the size of the enterprise is different, the nature of the enterprise and the cultural concept, the management method and the development goal can be different, and the relationship between the enterprise members can also be diverse, but they have the same characteristics, and have same goals. The alliance is conducive to the realization of common goals<sup>[7]</sup>. Based on the acquisition of resources, the enterprise is in a network of relationships, which facilitates the exchange of resources and achieves complementary advantages.

### **2.3 Network alliance and enterprise technological diversity**

The alliance network enables enterprises to have access to external information and knowledge resources, promotes the flow of knowledge and information between enterprises, and realizes resource sharing, thereby enhancing enterprise innovation and realizing technological diversity. The success of an enterprise often requires cooperation between individuals and organizations, and alliances between various enterprises form an alliance network. The collaborators mainly influence the creative ability of the enterprise by influencing the enterprise's ability to obtain resources in the network. The central position occupied by partners is an indicator

of the company's position and power. The more a company occupies a dominant position, the more ways it can obtain resources, thereby achieving faster innovation, generating more technology, and enhancing its own competition. Strength, stabilize the position in the network alliance, enhance the trust between partners, closer connections between partners ,and ultimately better promote the development of technological diversity.

### **2.3.1 Number of partners**

The number and diversity of partners are important factors affecting the technological development of enterprises. The number of partners refers to the size of the participants. Large corporate cooperation teams can concentrate multiple ideas and more easily obtain the required intellectual and scientific skills, thereby generating new combinations and perspectives that have a positive impact on technological diversity. Individual entrepreneurs are more likely to "copy familiar views based on their own life experience." Research breakthroughs require a series of intellectual and scientific skills, and cooperation will far exceed the abilities of any one person. However, some scholars believe that innovation and development is an interactive learning process between close partners. This close cooperation promotes trust between all parties. At the same time, a certain common norm and practice must be established. Once deviated from the norm, the partner will be disqualified from cooperation, which also inhibits innovation. These processes that require compliance with standards may have a negative impact on the creation of technological diversity. For a large number of corporate teams, more coordination is required, which requires companies to better comply with rules and standards, thereby reducing innovation. Therefore, some scholars hold a positive view on the influence of the number of partners on the technological diversity of enterprises, while some hold a negative view. Frank J et al. conducted an empirical study and proposed that the more partners there are, the lower the creation of technological diversity<sup>[8]</sup>. This study makes hypothesis 1: The number of the company's partners is positively related to the creation of the company's technological diversity.

### **2.3.2 Diversity of partners**

The diversity of partners refers to the differences in the types of participants. Business partners can include small and medium enterprises, large enterprises, knowledge institutions, government organizations and intermediary organizations. A small and medium enterprise is a company with no more than 250 employees; more than 250 employees means that the company is a large enterprise. Small and medium-sized enterprises are generally regarded as more innovative than large enterprises, which have more resources and experience. Knowledge institutions are non-profit institutions engaged in basic research or applied research, such as universities or public research institutions. Government organizations are public organizations. They can increase financial subsidies for corporate development and formulate policies that are conducive to corporate development. Intermediary organizations are organizations that promote dialogue between partners, such as branches and special interest groups. Powell et al.<sup>[9]</sup> believe that the diversity of partners is more important than the number of partners. In short, different partners bring their unique knowledge and skills to the enterprise, and can combine the resources of all parties to form a new concept, which creates technological diversity. This research makes hypothesis 2: The diversity of the company's partners is positively related to the creation of the company's technological diversity.

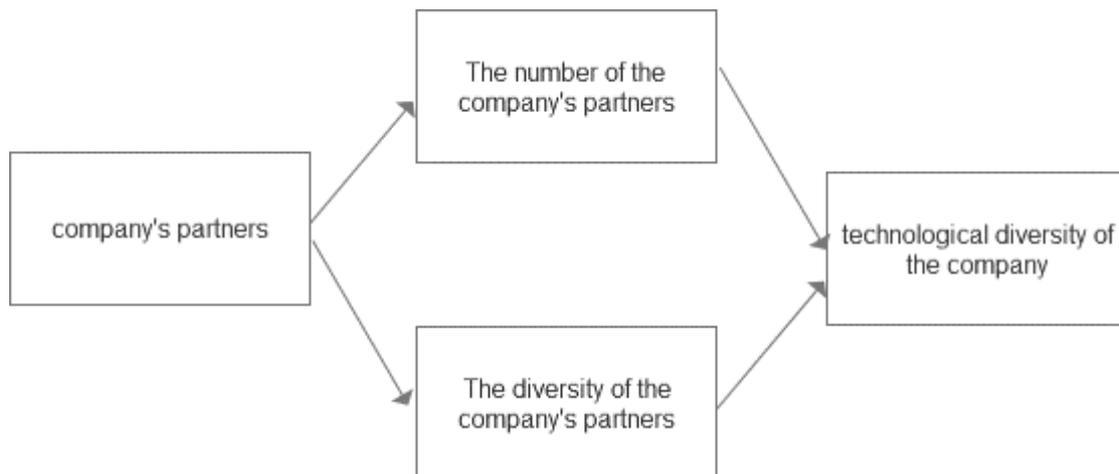
### **2.3.3 Network resource acquisition ability**

Cooperators mainly influence the creative ability of the enterprise by influencing the enterprise's ability to obtain resources in the network. Enterprises can obtain the knowledge they need through the channel of knowledge sharing<sup>[10]</sup>. Resource integration refers to the selection, extraction, allocation, activation and organic integration of resources from different sources, levels, structures, and contents by enterprises, so that they have strong flexibility, orderliness, system and value, and form new core resources<sup>[11]</sup>. The positive promotion effect of resource integration capability on the performance of new ventures has been fully verified by domestic and foreign research. Therefore, improving the resource integration capability has important theoretical and practical significance<sup>[12]</sup>. The strength of an enterprise's ability to integrate resources has a great influence on its acquisition of new knowledge, and the use of new knowledge will affect the development of enterprise technology. Compared with competitors with weak resource integration capabilities, companies with strong resource integration capabilities can effectively use the resources in the alliance network to transfer and utilize them. The process of enterprise integration of resources is also the process of cooperating with others. The stronger the resource integration ability, the closer the connection with partners, which further stabilizes the way to obtain resources. Strong resource integration ability can timely obtain knowledge, technology and other resources that they do not possess from multiple channels, and quickly select high-quality resources, which accelerates the innovation of enterprises and is conducive to the development of technological diversity.

### III. Model building

Enterprises cooperate with each other to form network alliances. The number and diversity of enterprise partners affect the enterprise's ability to obtain resources and ultimately affect the enterprise's ability to develop technology. The transfer, absorption, and sharing of knowledge resources between enterprises in the alliance network is inevitable. Through resource sharing, partners can enhance each other's knowledge, develop together, and achieve common goals. Similarly, the effective use and reintegration of superior resources of members can also generate more knowledge and technology. Partner companies, scientific research institutes, schools and other institutions through industry-university-research cooperation. For example, colleges and universities transfer related knowledge to the company, and establish a new networked organizational structure, which is more conducive to innovation and technology diversity for enterprises.

Figure 1: Conceptual model



According to the conceptual model, this paper makes the following two assumptions.

Hypothesis H1: The number of the company's partners is positively related to the creation of technological diversity of the company.

Hypothesis H2: The diversity of the company's partners is positively related to the creation of the technological diversity of the company.

### IV. Research and analysis

Due to the need to study the model and assumptions, each dimension in the model must be quantified. The variables involved are the number and diversity of partners. This article uses the number of patents of a company to represent the company's technological diversity. This paper collects the number of partners of 20 companies, the number of collaborations with companies in different fields, and the number of companies' patents, and uses the scale as a measurement tool for correlation analysis and multiple linear regression analysis. The Likert scale is the most widely used scale in research. It expresses the respondent's attitudes and views on the measurement items through five categories: "strongly agree, agree, general, disagree, strongly disagree" or "very agree, somewhat agree, general, disagree, and strongly disagree". This article uses Likert's 5-point scale to measure the attitudes of the respondents, where "1=completely disagree", "2=relatively disagree", "3=unsure", "4=relatively agree" and "5= totally agree".

Table 1: Measurement scale

variable	number	content
company's partners	C1	cooperate with multiple companies
	C2	cooperate with companies in many different fields
technology	T1	the number of patents

Note: C1 refers to the number of enterprise partners; C2 represents the diversity of enterprise partners; T1 refers to the diversity of enterprise technologies

#### 4.1 Correlation analysis

Before performing multiple linear regression analysis on the hypothetical model, we must first perform correlation analysis between variables. The results of correlation analysis are shown in Table 2. It can be seen from Table 2 that the correlation between the number of the company's and the technological diversity of enterprises has reached a significant level( $r=0.717$ ,  $p < 0.01$ ),and the correlation between the diversity of the company's and the technological diversity of enterprises has also reached a significant level( $r=0.584$ ,  $p < 0.01$ ).

**Table 2:Correlation coefficient**

variable	T1
C1	0.717**
C2	0.584**

Note: \*\* means significant at the 0.01 level, \* means significant at the 0.05 level

#### 4.2 Multiple linear regression

This study uses multiple linear regression methods to test the impact of the number and diversity of enterprises on the technological diversity of enterprises. It can be seen from Table 3 that there is a significant correlation between the independent variable and the dependent variable. The results of multivariate regression analysis with SPSS are shown in the following table:

**Table 3:Multiple regression analysis**

variable	T1
C1	0.055**
C2	0.674**

It can be seen from Table 3 that the number and diversity of corporate partners have a significant impact on corporate technological diversity. It can be seen that the assumptions H1 and H2 are both established and the number of corporate partners is positively related to the creation of corporate technological diversity Relationship, the diversity of corporate partners is positively related to the creation of corporate technological diversity, and the diversity of corporate partners has a greater impact on corporate technological diversity than the number.

### V. Conclusion

This study proves that the number and diversity of business partners are positively related to the diversity of business technology. The larger the number of corporate partners, the more potential information the company can obtain from the alliance network, and the greater the number of corporate partners, the easier it will be to obtain heterogeneous resources from the alliance network,so it's easier to develop technical diversity. At the same time, for companies with a lack of internal resources and capabilities, in addition to building alliance networks, actively cooperating with different companies, but also need to pay attention to occupying a favorable network position in the alliance network and effectively using resources.

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