

The Effect of Network Embedding on Innovation Performance: Based on the Moderating Effect of Knowledge Distance

Yubing Han

School of Business, Nanjing Audit University, Nanjing, 211815, China

Abstract: Based on the network embedding theory and innovation performance, and taking knowledge distance as a moderating variable, case and empirical research methods are adopted to explore the relationship between network embedding and innovation performance, and to reveal the role of knowledge distance in the relationship between network embedding and innovation performance. The research results have important theoretical and practical value for further improving the structural characteristic system of innovation network and the knowledge flow mechanism of knowledge distance inside and outside enterprises, and further enrich and expand the theory of enterprise innovation performance.

Keywords: Network embedding, Knowledge distance, Innovation performance.

1. Introduction

Nowadays, technology and market demand are in rapid development and change, so innovation has become an important force to improve competitive advantage in economic development (Tushman&Anderson,1986). As "community of common destiny" increasingly becomes the trend of economic development and technological innovation in various industries becomes more and more complex and diversified, enterprises tend to join the cooperative network to improve innovation efficiency. From the perspective of organization management, network is in line with the requirements of enterprise operation norms and systems; From the perspective of resource-based view, the role of network is to provide resources for enterprises, while the core of innovation is the integration of heterogeneous resources and the reorganization of knowledge, and a multi-dimensional resource-sharing mechanism can be formed with other subjects by constructing cooperative network (Reagans& Mcevely,2003). Enterprises can obtain non-redundant resources such as knowledge and relationships through multi-dimensional embedding of cooperative networks, thus promoting R&D activities. However, enterprises in the cooperative network often do not know how to choose the complicated external resources. The main reason is that the innovation subject lacks proper cognition method and cannot obtain the required knowledge and relation resources, which restricts its rapid development. Therefore, the impact of multiple embeddedness in cooperative networks on enterprise innovation performance has become a hot topic in enterprise innovation management. In the context of "Open innovation", the competitive relationship between enterprises has turned to competition and win-win. In order to adapt to this change, enterprises need to actively integrate into the innovation network. Therefore, how to construct and manage the relationship and position of enterprises in the innovation network, so as to improve the innovation performance of enterprises, has become an important problem to be solved urgently. In addition, under the background of open innovation, the technology and resources required for enterprise R&D innovation are more dispersed, the spillover

speed is accelerated, and the innovation cycle is shortened, which leads to the delay and risk of R&D innovation and affects the benefits of technological innovation.

According to the social network theory, an enterprise's innovation activities are usually embedded in the social network (Kim,2014) and deeply influenced by it. Especially under the background of open innovation, more and more enterprises maintain their competitive advantages in R&D and innovation through Network embeddedness. Previous studies have explored the relationship between network embedding and innovation performance and its mediating mechanism. For example, from the perspective of learning, open learning, exploratory learning, learning ability; Knowledge integration based on knowledge management; And differentiation strategy and entrepreneurship orientation from the perspective of strategic management. However, few studies have explored the relationship between network embedding and innovation performance through the conduction of knowledge distance. Therefore, this study intends to explore the internal mechanism of the transformation from network embedding to firm innovation performance from the perspective of knowledge distance.

2. Literature References

2.1. Network Embedding

Network embedding refers to the degree to which the focal relationship between an enterprise and its partners is embedded in the interconnected network (Uzzi,1997). Social network theory emphasizes that the relationship and structural quality of a network are critical to its participants (Caniels & Romijn,2008). Therefore, some scholars divide network embedding into two dimensions: structural embedding and relational embedding (Meuleman, et al.,2017). Among them, structure embedding refers to the position of the organization in the network structure, emphasizing the configuration of the relational network of an actor. Relationship embedding refers to the direct or indirect relationship and the degree of mutual understanding, trust and commitment formed in the process of cooperation, emphasizing the role of relationship quality.

From the perspective of structure embedding, the quality of enterprise resource access is affected by the location in the cooperative network. First, social capital scholars emphasize that structural embedment can influence the improvement of enterprises' products or services and other innovative activities (Perez-Luno, et al.,2011). Secondly, enterprises in a dominant position in the network can obtain effective technical resources with low search cost, absorb and improve these resources, and transform them into non-R&D innovation achievements by selecting the optimal patent and technology portfolio, so as to reduce the risk of technological failure. Thirdly, by occupying a favorable position in the cooperative network, enterprises can broaden the channels for obtaining heterogeneous information, which is helpful for enterprises to acquire external technologies and carry out imitation production or reverse engineering of technologies. Finally, enterprises with stronger structural embeddedness have higher status in network structure and stronger network centrality. Therefore, it can get closer to users and understand their needs, thus promoting the realization of user innovation (Mazzola, et al.,2014).

From the perspective of relationship embedding, the establishment and maintenance of a good cooperative relationship between an enterprise and its partners can prompt the enterprise to obtain real and reliable market and technical information in a timely manner, which is conducive to the realization of its sustainable non-R&D innovation. First of all, enterprises embedded in the network can establish a foundation for transferring resources across boundaries between organizations by establishing reliable relationships with senior executives of partners, and at the same time provide guarantee for improving enterprise technology and continuous innovation (Tabbaa&Ankrah,2016). Secondly, long-term stable cooperation with other enterprises embedded in the network can help enterprises obtain external technology, facilities and other resources at a low price, accelerate the imitation production or reverse engineering of products or processes needed by the market, so as to promote the development of non-R&D innovation activities of enterprises. Thirdly, enterprises embedded in the network can obtain industrial technical information in a timely manner by building collaborative relationships with partners, thus improving decision-making efficiency and enhancing organizational learning ability and adaptability (Ryu, et al.,2013). Finally, in order to grasp the real needs of users, it is necessary to maintain a strong connection with users; Frequent technical knowledge exchange and interaction between enterprises and users can improve user experience and participation (Flynn, et al.,2010), thus promoting the realization of user innovation.

Network embedding is a stable connection gradually formed by enterprises due to past exchanges and contacts, which determines the difference of resources obtained by enterprises, thus affecting the growth of enterprises. Studies show that network embedding can provide enterprises with diversified knowledge and innovation resources (Letaifa&Goglio,2016), through which enterprises can establish cooperative relationships and identify new development opportunities to achieve rapid growth. However, some studies have shown that network embedding has some disadvantages, such as homogenized information and cognitive lock, which reduce the acuity of enterprises to obtain information and thus restrict the growth of enterprises.

The operation of enterprises is embedded in the social network in which they are located, and mutual social relations between organizations and social and cultural factors affect the effect of activities (Granovetter,1985). In other words, technology-based enterprises can obtain knowledge resources to achieve rapid growth by virtue of network embedding mechanism. Network embedding is divided into structure embedding and relation embedding. Structural embedding reflects the position of the subject in the social network (Gulati,1998). Network location reflects an enterprise's ability to acquire and control information and resources (Gulati,1999), as well as its social status and reputation, which plays a positive role in seeking high-quality partners and realizing innovation benefits. Centrality can enhance the knowledge accumulation of enterprises and improve the ability to identify and absorb new knowledge and convert it into enterprise value (Mazzola et al.,2015). Relationship embedding reflects the degree of trust interaction frequency and connection persistence among network members (Lyu,et al.,2019), and determines the situation of enterprises' acquisition, integration and utilization of resources. The closer the network members are, the more opportunities they have to contact and acquire heterogeneous resources. The higher the trust degree of network members, the stronger the willingness to share and transfer information, promoting the improvement of enterprise innovation performance.

2.2. Knowledge Distance

Knowledge distance is essentially a structural and hierarchical variable, whose base layer is the difference in knowledge background, stock and structure between the two sides of knowledge interaction, and the cognitive layer is the difference in knowledge concept, management and value between the two sides. The competence level is the gap of learning, integrating and applying knowledge between the two parties at the base level and the cognitive level (Cummings&Teng,2003). The existence of knowledge gap will reduce the fit degree of knowledge activities between organizations, mismatch knowledge supply and demand, and cause the knowledge learning process to be too long, thus weakening the driving effect of external knowledge resources on the growth of technical ability (Gaffney, et al.,1998). Some studies have shown that knowledge distance has a negative moderating effect on the positive relationship between network centrality, network diversity, relationship strength, relationship quality, knowledge teachable and knowledge observability, respectively.

The proposal of knowledge distance comes from cooperative innovation research's concern about the gap in knowledge base between both parties in the process of partner selection, because the matching of knowledge base can effectively reduce the cost of cooperation (Capaldoetal,2017). The theory of knowledge creation points out that the transformation between different forms of knowledge will lead to differences in knowledge cognition, understanding and application of organizations. From the definition of scope, knowledge distance is not only the difference in knowledge base and knowledge reserve, but also the gap in knowledge ability matching between the two sides. Scholars' definitions of knowledge distance also reflect the above connotations. Cummings et al. (2003) pointed out that knowledge distance refers to the gap between knowledge source and knowledge receiver in the process of processing the same knowledge. Schulze et al. (2012) proposed that knowledge distance is the

degree of differentiation of partners in specific knowledge elements. Qian et al. (2009) regard knowledge distance as the difference in knowledge structure between two types of different knowledge bodies based on the same knowledge basis. From the perspective of external knowledge acquisition and transfer, knowledge distance is used to measure the difficulty of knowledge transfer from one knowledge system to another, reflecting the matching of knowledge provider and knowledge receiver in the knowledge system.

Under the effect of knowledge distance, the effect of network diversity on technical ability will also change: First, from the perspective of network theory, acquiring and absorbing external knowledge of various uses can improve the potential creativity of enterprises, avoid the "innovation trap" of developing and applying external knowledge, and provide a foundation for innovation governance (Lee et al., 2012). However, when the knowledge receiver lacks sufficient knowledge base and the organizational knowledge system is in disorder, enterprises will have problems such as knowledge overload and fuzzy knowledge recognition when absorbing and synthesizing complex knowledge units from multiple channels. Second, although network diversity provides benefits for the growth of enterprises' technological capabilities, enterprises need to spend more efforts and resources to digest and integrate exogenous knowledge due to the increase of knowledge functional gap, and the scale economic benefits of innovation will be weakened (Delbufalo, 2015). Third, external knowledge acquisition needs to cross organizational boundaries. External organizations can display and transmit knowledge in a variety of ways to promote enterprises' learning and mastery of external knowledge. But if there are too many barriers to the flow of knowledge, it can make it difficult or inefficient to combine across borders. The advantages brought by network diversity for multi-source accumulation of knowledge and collaborative growth of technological capabilities of enterprises will not be played (Goerzen et al., 2005).

2.3. Innovation Performance

Since economist Schumpeter put forward the concept of "innovation", the problem of enterprise innovation performance has attracted great attention of scholars. In addition to the traditional perspective of R&D investment and patent application, scholars extend the measurement of enterprise innovation performance to seven aspects, including resource allocation, identification of competitor strategy, new products to meet market demand, prediction of technological change, new products to use technology, market rapid response and organizational learning.

Amabile (2007) believes that innovation performance refers to innovative and practical viewpoints and ideas on products, services or processes generated by employees. According to Bruce and Scott (2010), employee innovation performance refers to the process in which employees put forward new ideas or solutions and seek supporters based on the problem-oriented principle, and then "productize" innovative ideas. Foreign scholars on corporate performance indicators to measure is based on the indices such as R&D, Griliches (2015), and other scholars said in a high technology enterprise, the early R&D spending will lead to its R&D investment in the follow-up, the success of the early development, the catalyst of R&D investment in the late so you can use the R&D reflects the enterprise innovation performance. As for patents, Bresman et al. (2017) said that enterprises did not

distinguish the importance of patents when assessing the number of patents, which would lead to deviation in measurement. Therefore, many scholars turned to indicators such as new technology, new process and new product to measure innovation performance of enterprises. Scott and Bruce (2015) believe that individual innovation performance is a three-stage process of problem identification, seeking innovation support and realizing innovation performance based on process perspective. By reviewing and summarizing previous literature on innovation performance, Kleysen and Street (2018) concluded that individual innovation performance includes five stages: opportunity seeking, idea generation, investigation formation, support and application. Taggar (2016) divides innovation performance into team-level innovation performance and individual-level innovation performance according to the level of innovation performance, and points out that innovation performance at the individual-level may be affected by a variety of factors such as individual initiative, work motivation and big Five personality traits. Benner et al. (2016), based on the characteristics of innovation results, divide innovation performance into breakthrough innovation performance and incremental innovation performance. Incremental innovation performance includes the improvement of the status quo and is built on the existing technological track, while breakthrough innovation performance means the transfer to a completely different technological track. Madjar et al. (2016) believe that there is an orthogonal relationship between the two types of innovation performance, that is, the two types of innovation performance are independent of each other, but not separated. As ideas are optimized and implemented, incremental innovation performance may eventually be transformed into breakthrough innovation performance.

3. Conclusion

From the existing literature, the research on the relationship between network embedding and enterprise innovation is highly valued by the academic community at home and abroad. By summarizing the literature, it is found that enterprises' integration of external network resources is mostly based on knowledge transfer, and the utilization effect of external knowledge resources is affected by cooperative enterprises themselves, cooperative partners and cooperative networks. But lack in the knowledge from the existing research situation of embedded network and the relationship between the enterprise innovation ability research, less to the network embedded research how to improve the weak enterprise innovation ability, at the same time, the existing research studies from the macro level to bring the influence of the innovation performance of network embedded, ignored the specific empirical analysis of the micro mechanism. Based on the above considerations, the influence of the knowledge distance between the upstream and downstream partners of the value chain on the innovation capability of enterprises cannot be ignored in addition to the network embedding characteristics in the understanding, interpretation and application of knowledge.

As an important part of social operation, manufacturing enterprises play a key role in providing novel, flexible and creative products and solutions for the society, and the efficient network embedding mode is particularly important in improving enterprise innovation performance. Scholars at

home and abroad have done some research on the influencing factors of innovation performance and put forward many important theories. As one of the important characteristics of enterprise innovation activities, knowledge distance has a very important impact on innovation performance. Therefore, it can be concluded that network embedding and innovation performance, as well as the influence of knowledge distance on the relationship between them, are intricately related. Only by accurately grasping these relations and clarifying the influence mechanism between variables can network embedding model be effectively configured to promote the improvement of enterprise innovation performance.

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