Review on the influence of enterprise network power on innovation performance

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Abstract. With the advent of economic globalization and knowledge economy with information technology as the core, innovation has increasingly become one of the important sources of building the core competitiveness of enterprises. In the network environment, enterprises are actively or passively embedded in various complex networks, and no enterprise can have a complete sense of technological innovation activities independent of cooperation. As long as there is information exchange and knowledge flow, network power will be derived. Power is the foundation of network governance, and rational allocation of network power has become one of the effective means to improve the innovation performance of network organizations. This paper first defines the relevant concepts of enterprise network power and innovation performance, and then reviews the impact of enterprise network power on innovation performance from four aspects: the relationship between the two, network power allocation, different network power classifications, and different research perspectives. Then, based on existing research results, it discusses and looks forward to future research directions.

Keywords: Network power; Innovation performance; Industrial cluster.

1. Introduction

The 14th Five-Year Plan emphasizes the development of strategic emerging industries, giving play to the leading and supporting role of large enterprises, and enhancing the integration and innovation among individuals in the enterprise network. Under the background of digitalization, enterprise network gathers innovation resources and elements to enhance independent innovation ability. Both Huawei and BYD improve their enterprise performance through the formation of enterprise networks and complete their innovation activities on this basis. The structure and mechanism of enterprise network power have evolved into an important factor affecting innovation performance, which plays an important role in the normal operation of enterprises.

Foreign scholars (Levin, 1998) [1] have long pointed out through empirical research that power in an efficient network organization will improve the productivity of the organization. Domestic scholars (Wangqin, 2012) [2] analyzed power as the basis of network governance through a cross-case study. (Liweian, 2003) [3] believes that the study of network governance is a breakthrough to improve network performance. From both theoretical and practical perspectives, the governance of enterprise network needs to be evaluated by the operational performance of network organization, and power is the basis for the normal operation of network organization. In order to improve the governance performance of enterprise network and improve the governance effect of enterprise network, it is necessary to analyze the influence of network power on innovation performance under different circumstances from the perspective of network power. This paper aims to answer two questions: First, why does corporate network power affect innovation performance? Second, how does corporate network power affect innovation performance under different circumstances?
2. Overview of enterprise network rights

2.1 Network Power

Power is a concept often used in human life, and all orderly organizational activities have the role of power. The term "power" was first coined (Emerson, 1972) [4] and is mainly used in the fields of sociology and political science. According to contingency theory, power is essentially the ability to own, control and influence others in order to achieve one's own goals. The difference of knowledge resources leads to asymmetrical dependence among cooperative enterprises, which leads to power. Network power originated from the interpersonal network research in the field of sociology, that is, individuals embedded in social networks have the power to influence others. (Castells, 2011) [5] Creatively proposes that power comes into play when members of a networked society connect with each other. There are four different forms of power: first, the power to form a network, a business or an organization. Power in a network includes the ability to form a network system with itself at its core; The second is the power in the network, which comes from the ownership of standards and rules in the cooperation and communication process of the member enterprises in the network. The second is network power, the power of social members exceeds the power of other members in the network, and this power is determined for each specific network. Finally, the network creates power: members with this power can formulate specific forms of network organization, according to their own interests, values, and the power to switch to different networks at any time according to the status of strategic alliances.

2.2 Enterprise network power

Enterprise network power evolved from social network power, and the academic research on enterprise network power began with the attention to the non-equilibrium characteristics of enterprise network. In the 1980s, economists used the network analysis method for reference and applied it to the research in the economic field, and gradually formed the enterprise network theory. The network power formed by enterprises in cooperative innovation is the ability of enterprises to influence and control the behavior of partners. Enterprise network power is a relatively complex concept, which can be understood from three aspects: first, the actors are not general social units, but mainly enterprises. Power is formed in the process of economic practice activities of enterprises, and it crosses the boundaries of enterprises to evolve into network power; Second, network power can only exist in relation to other actors, and the basis of existence is lost without the power of the partner. Third, enterprise network power needs to be recognized from a multidimensional perspective. For example, (Maloni et al., 2000) [6] classifies enterprise network power into remuneration right, coercion right, expert right, guidance right, legitimate right, etc. (Zhang Wei et al., 2011) [7] classifies enterprise network power into knowledge right and structure right according to different configuration bases. Network power means that enterprises in a dominant position in the network control enterprises in a disadvantageous position, put their own innovation interests above partners, make partners cooperate according to their own wishes, and then create asymmetric interaction conditions, forcing partners to disclose technical knowledge and acquire more knowledge. (Liu Li et al., 2015) [8] believes that network power is an enterprise's ability to allocate network resources and obtain the optimal configuration scheme, and network power includes decision-making power and influence.

3. Overview of innovation performance

3.1 Overview of innovation performance

Organizational innovation performance can be divided into a narrow sense and a broad sense. In the narrow sense, organizational innovation performance refers to the level of innovation and the result of innovation, while in the broad sense, organizational innovation performance refers to the result performance in the innovation process, including the actual output and service of
There are three main viewpoints on the definition of the connotation of organizational innovation performance: Process perspective: mainly focuses on the behavioral process, and proposes that organizational innovation performance is a behavioral process in which employees constantly grow and shift the focus of knowledge in the process of acquiring and sharing knowledge to maintain their own advantages (Han Yi, 2007) [9]. Result view: That is, taking organizational innovation performance as an indicator to measure corporate profits, it refers to increasing profits and achieving goals by changing products and services to meet customer requirements, which can also show whether an enterprise has achieved its innovation goals (Smart, 2008) [10]. While emphasizing results, innovation performance is influenced by human characteristics, task characteristics and environmental factors. Role perspective: In the process of studying organizational innovation performance, it is proposed that organizational innovation performance is the interaction between the innovation activities and the innovation environment of the enterprise, and is the enterprise's own (AGGEFI,1999) [11]. Most scholars accept the second view. The results point of view gives two important aspects to examine innovation performance, namely effectiveness and efficiency. Effectiveness refers to the satisfaction compared with expectations, the speed of new product development and the speed of new market development, and efficiency refers to the time schedule compared with input and output, the time of new product development, cost and satisfaction. (POTI, 2001) [12] believes that from a macro perspective, that is, from the level of the whole country, innovation performance refers to the growth of the national economy and the improvement of the welfare of the whole people. From the perspective of middle view, that is, from the regional level, innovation performance is the growth of regional economy. From the micro perspective, that is, from the enterprise level, innovation performance is the increase of enterprise output. (Jiang and Li, 2009) [13] pointed out that innovation performance refers to the change of enterprise innovation output after and before cooperation to a certain extent.

3.2 Measurement of innovation performance

Innovation performance includes technological innovation performance and management innovation performance. (Dafrl, 1978) [14] The technological innovation performance of an enterprise is measured according to the number of new products owned by the enterprise, the number of patents obtained, the new process and the production mode. The management innovation performance of enterprises is measured from the aspects of strategic planning, process management and organizational governance. Some scholars have proposed that the measurement of innovation performance is multidimensional, and a single dimension cannot reflect the output of innovation. The innovation performance of enterprises after cooperation is represented by the increase in the number of new products and the improvement of market innovation performance. (Gopal et al., 2010) [15] research believes that network innovation performance should be measured from two aspects: benefit and efficiency. Specifically, the network innovation benefit measures whether the innovation results meet the expected satisfaction, including the cooperation satisfaction survey of network members, the market success rate of network innovation products, and the number of network patent applications. Network innovation efficiency measures whether the network innovation process is effectively managed, including the speed of new product development and the annual output of new products. Most scholars refer to the studies (Hagedoorn and Duysters, 2002) [16] and point out that enterprises acquire knowledge and technology through cooperation. Thus, technological innovation performance (number of new product R&D, new process technology, introduction of new technology), financial innovation performance (reduce R&D cost of knowledge and technology update, compress R&D time, shorten technology update cycle), and market innovation performance (expand market size and enlarge enterprise market effect) can be improved.
4. Network power and innovation performance

4.1 Relationship between network power and innovation performance

As an important factor affecting the operational performance and governance effect of network organizations, as well as an important basis for explaining and predicting the economic and social behaviors of cooperative nodes, network power has not attracted enough attention from scholars for a long period of time, but in recent years, it has attracted more and more attention from the academic community and gradually evolved into a hot issue. Current studies have explained that the emergence of network power is due to the fact that a certain enterprise has key resources and makes other subjects in the network organization depend on it. Under normal circumstances, the greater the network power, the more advantages enterprises have in choosing partners, which will bring many knowledge resources conducive to enterprise innovation. At the same time, the stronger the network power, the more enterprises can grasp the development trend of technological innovation in time, which is conducive to enterprises to occupy the core competitive advantage position in advance, make up for and prevent the uncertainty risk caused by innovation, so as to improve the innovation performance of enterprises. In order to improve the innovation performance of complex network organizations, the main way is to influence the level of inter-organizational relations through the governance of network subject power.

On the interaction between network power and innovation performance, scholars have conducted a wealth of research and demonstration from different perspectives. From the perspective of digitalization, (Chen Jian, 2020) [17] points out that under the new background of digitalization, enterprises' operating environment, product creation process and products can be greatly changed, and operation management model innovation can be realized to achieve digital innovation. (Chen Dongmei, 2020) [18] believes that digitalization raises four issues, namely, enterprise existence, enterprise boundary, internal organization, and competitive advantage. From the perspective of clusters, (Dai Wanliang, 2019) [19] points out that the unique network power of individual enterprises in enterprise networks enables them to acquire knowledge from the outside and thus be absorbed and utilized by enterprises to form innovative competitive advantages. (Yu Yonghai, 2014) [20] pointed out that the formation of networks among enterprises is an effective way to capture external resources; (Zhang Wei, 2011) [7] Empirically proves that network power affects innovation activities through knowledge power and structure power; (Zhang Hongjuan, 2021) [21] The influence of power on performance can be divided into two action paths: knowledge and scale. Individuals in the central position of enterprise network influence external R&D and knowledge flow among members through network power, thus affecting the innovation performance of the cluster. Scholars have fully demonstrated the positive role of network power in promoting innovation performance.

4.2 Influence of network power allocation on innovation performance

Network organization is the necessary platform for enterprises to improve innovation performance. Network organization is a loose association, and interdependence is the basic feature of the participants, which means that the network cooperation relationship is largely affected and modified by the power distribution structure. (Granovetter, 1985) [22] shows that under certain conditions, only network structures with hierarchical differences can better coordinate the contradictions and conflicts among economies in the network. (Wasserman, 1994) [23] pointed out that there is certain power in the network, and when an enterprise has the key resources that other network members rely on for survival, that is, when an enterprise obtains the right to control the flow of resources in the network, it is very important to explore the far-reaching impact of this type of enterprise on social and economic development. (Kahkonen, 2014) [24] analyzed the influence of power on the depth of cooperation by examining the power relationship and cooperation relationship between supply and demand in the network, and found that the power of actors in the network affected the formation of cooperation relationship and the depth of cooperation. In economic practice, the behavior of network nodes is directly affected by their power, and the competitiveness and market
position of network nodes directly affect their role and position in the whole network. Theoretically speaking, it is precisely because of the unequal economic power of nodes in the network or their different positions in the network that they guide and influence their economic and social behaviors, and then affect the operational performance and governance effect of network organizations.

Network power is the ability of influence and control in the process of network exchange and coordination. The relative position of an enterprise in the innovation network affects its own ability to acquire information and knowledge. At the same time, the core enterprise in the technological innovation network is easy to obtain resources inside and outside the network, and ultimately affects the innovation performance of the network. Centrality and intermediation determine network status, and enterprises with strong status consciousness will use the power brought by network status to seek benefits (Sozen, 2012) [25]. The closer an enterprise is to the center of the network, the more innovation opportunities it has and the more extensive knowledge resources it possesses. Enterprises with greater power can coordinate the relations among organizations and unify the thoughts of network members, which is conducive to the generation of consensus and convention in the network. (Massimo, 2013) [26] believes that individuals in a dominant position are more likely to obtain scarce resources, thus effectively promoting individual innovation performance and enhancing the ability of enterprises to deal with various relationships on the network to obtain a higher rate of technological innovation. Enterprises in the core position of enterprise network have better information sources and channels, stronger ability to obtain scarce resources and capture competitive advantages, and cooperate with excellent enterprises to achieve high-quality innovation (Qian Xihong et al., 2010) [27]. Such enterprises have heterogeneous resources that are different from other network members, and their transaction costs can be greatly reduced, thus shortening the time of technology research and development and improving innovation performance (Ma LAN et al., 2016) [28]. (Jinyi, 2021) [29] It is found that in the innovation network, the influence of network power (knowledge power and relationship power) on the firm's own breakthrough innovation presents an inverted U-shaped relationship. Through the cross-case exploratory analysis of 3 enterprises and the questionnaire survey of 233 enterprises, it is found that too low or too high knowledge power and relationship power are not conducive to enterprises to carry out breakthrough innovation, and only moderate knowledge power and relationship power can improve the level of breakthrough innovation.

4.3 Influence of different network power classifications on network innovation performance

The mainstream research divides network power into knowledge power and structure power. (Deng Feng, 2015) [30] believes that the dominant body in the network can ensure the creation and acquisition of value through knowledge transfer and innovation, so as to control and coordinate other members of the network organization, so as to improve the performance of network governance. Knowledge resources are the core resources of innovation network, so the dependence on knowledge power is precisely due to the different needs of different subjects in the network for knowledge resources, which results in the network knowledge power. (Dang Xinghua et al., 2011) [31] believes that innovative network organizations are more dynamic and complex than traditional organizations. Based on the domination of knowledge power and dependence on knowledge resources, innovative network organizations are essentially a kind of governance of the inter-subject relationship of network behaviors based on knowledge power. The greater the knowledge power of a network subject, the more key resources it has, the greater its influence on other members of the network, and the higher the dependence of enterprises in the network on it. The effective use of knowledge power can accelerate the speed of product research and development, improve product efficiency and enterprise performance, and the improvement of core enterprise efficiency in network 5 means the improvement of the overall innovation network performance.

The dominant position of an enterprise in the network can also bring power to it, that is, structural power (Wasserman, 1994) [23] defines structural power as the ability of an enterprise to influence the behaviors and activities of other network members because it occupies the dominant position in the network. Because the enterprise occupying the central position of the network can connect a large
number of network nodes, it can obtain the required information and resources from more network members than other network entities. On the one hand, if the actors in the network occupy a large number of structural holes or the central position of the network, they can quickly acquire effective information in the network and easily become the "knowledge gatekeeper" of the network (Nahon, 2009) [32], thus forming "gatekeeper" control over the vulnerable members in the network. It can block the vulnerable people in the network to obtain the information in the network and reduce the efficiency of the network. On the other hand, the asymmetry of the power of the inter-subject structure in the network damages the interests of the weak members, and the high-power subject punishes the disobedient weak enterprises to make them act according to their own goals, which leads to the decline of the overall performance of the network. (Volgger, 2014) [33] et al. believe that the difference of structural power among enterprises leads to the reduction of target planning and management effect. The widespread asymmetry of structural power in the network not only limits the participation of vulnerable groups, but also limits the innovation ability of the market.

4.4 Influence of network power on innovation performance from different research perspectives

Industrial cluster is a network structure which is based on geographic agglomeration and connected by multiple heterogeneous subjects. Knowledge, information, talents, technology and other resources flow in the cluster. For cluster enterprises, the process of innovation is actually the process of processing, reorganizing and integrating related knowledge, information and other resources. Therefore, the acquisition of elements such as innovation ability and resources is closely related to innovation performance, and the size of an enterprise's network power in the cluster is directly related to the acquisition of key resources. As a special form of industrial organization, the innovation performance of industrial cluster enterprises is the most direct response to its innovation ability. In the cluster, the internal enterprise organization is diversified, the connection relationship is diversified and so on to build a criss-cross cluster network.

At present, scholars have conducted some researches on the influence of network power on cluster performance. (TEECE et al., 1997) [34] believe that there are some powerful enterprises in the network, whose relationship ability can more effectively obtain scarce resources, promote innovation activities and improve innovation performance. (COLOMBO et al., 2013) [35] believes that enterprises with greater power in the network are more likely to obtain valuable knowledge resources and improve their innovation performance. It can be seen that the network power of cluster enterprises is an important factor affecting innovation performance. (Deng Feng, 2015) [30] classifies network power into knowledge influence and scale influence, and believes that core enterprises of industrial clusters indirectly affect cluster innovation performance through network operation efficiency through network power. (Lu Yibo et al., 2013) [36] defined the enterprise network behavior under "resource orientation" and applied the idea of network power distribution to build a multi-agent simulation model for the network evolution of small and medium-sized enterprise clusters. (Xie Yongping et al., 2012) [37] believes that competition and cooperation are the main contents of innovation network activities. Through reasonable use of network power, core enterprises can effectively coordinate the behaviors of network members, promote mutual trust and knowledge sharing among network members, reduce conflicts and reduce internal network consumption, and thus improve network innovation performance. Scholars have affirmed the promoting effect of network power on innovation performance, but there are few studies on the internal mechanism of network power's influence on innovation performance. (Han Ying et al., 2016) [38] Based on industrial cluster network power, knowledge sharing behavior is taken as the intermediary variable, and knowledge sharing behavior is divided by exploration and utilization (binary) perspectives. Further analysis of the influence mechanism of cluster enterprises' network power on innovation performance shows that the network power of cluster enterprises in the cluster has a significant positive impact on their innovation performance. In the context of industrial clusters, we should pay full attention to the rational use of core enterprises' network power, encourage exploratory
knowledge sharing among enterprises, and pay attention to the transmission role of knowledge sharing. Promote the improvement of innovation performance of cluster enterprises.

In addition to the perspective of industrial clusters, (Ma LAN et al., 2016) [28] analyzed the internal influence rule of enterprise innovation performance from the perspective of organizational learning theory. The research shows that the more enterprises participate in cooperative innovation experience, the more conducive to the improvement of enterprise innovation performance. Cooperation experience can help enterprises improve their ability to transform new knowledge, occupy an effective position in the network, gain the network power to influence and make decisions with other partners, and be in a favorable position for innovation and development to ensure the control of core competitive advantages. Enterprises digest and transform knowledge, need to go through a continuous honing process, in order to effectively transform the ability required for innovation, improve the innovation performance of enterprises. (Turker et al., 2014) [39] believes that enterprises in the innovation network are more likely to obtain information to improve innovation performance by establishing close connections with other cooperative enterprises, and are more likely to promote the development of overall innovation in the network.

5. Future research prospects

As an important factor affecting the innovation performance of network organizations, network power needs to be studied more deeply in the future.

(1) The current research on the influence of network power on organizational innovation performance is still at the theoretical level, and the research is relatively scattered. Analyzing the determinants of network power and dividing the importance of the determinants are the key contents to enrich and develop the theory of network governance. Therefore, it is necessary to synthesize the existing theoretical research results, identify the key factors among these determinants of network power, and enrich the research on the determinants of network power, so as to provide the correct direction for how to correctly use network power to improve innovation performance.

(2) Most of the studies adopted quantitative research methods, and few adopted case analysis methods. For such a complex organizational process as how enterprises use network power to influence innovation performance, case analysis method should be strengthened, because this method is more suitable to reflect the history, complexity and particularity of the research process.

(3) Existing literature often uses cross-sectional data to study the relationship between network power and innovation performance, which is very important for accurately grasping the characteristics and status quo of organizations. However, this method ignores the dynamic nature of the organization to some extent, and the longitudinal research should be strengthened to enhance the reliability of the data.

(4) As the business environment becomes increasingly complex and enterprises become more complex and dynamic, organizations should be regarded as adaptive systems when studying how enterprises affect organizational innovation performance. From the perspective of interaction and feedback, it is necessary to study how enterprises in the network use network power to radiate outward layers to affect employees’ innovation performance. The moderating effects of interaction and feedback should be further studied.

Reference


