

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(21), 2014 [13126-13131]

Overview of the researches on risk transmission and diffusion of the industrial clusters

Chun Huang

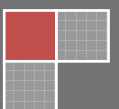
Zhejiang University of Finance and Economics, Zhejiang, Hangzhou, (P.R.CHINA)

ABSTRACT

As an important factor influencing regional economic development, cluster risk has attracted attentions of more and more scholars. The paper took network theory as a new perspective and network relationship as studying point, analyzed the documents on influence of internal network structure and network capacity on cluster risk transmission and diffusion, studied the influence of network structure (at meso level) on cluster risk (at macro level) from the perspective of enterprise network capacity (at micro level), and constructed the cross level analysis model of cluster risk transmission and diffusion.

KEYWORDS

Risk transmission; Risk diffusion; Industrial clusters; Network structure; Network capacity.



INTRODUCTION

Porter^[1] pointed out that industrial cluster may lose competitiveness due to external threat (e.g. technological discontinuity, changes of consumers' demand, etc) and internal rigidity (due to over-integration, cartel, the restraint of group thinking on innovation, etc.)¹. In fact, upon the establishment, the cluster is in dynamic evolution, with the risks of aging and distinction. The sustainable development is not the obvious attached characteristic of cluster. In particular, to a single structured professional industrial cluster, due to the reliance on single industry, its long-term outcome is to decline along with certain industry or product, and the whole regional economy is to be dragged down^[2], e.g. the decline of steel enterprises cluster in Detroit of U.S. and the area around No. 128 highway all severely affected the overall competitiveness of the regional economy (Martin & Sunley, 2003). Since financial crisis, the Chinese enterprises have been faced with severe international competition. Under the situation of lack of competitiveness of single enterprise, industrial cluster has become an effective organizational mode for Chinese enterprises to participate in international competition, and how to prevent and control enterprise cluster risk, and promote the sustainable development of regional economy is a real problem urgently needs to be solved by the theoretical circle. By analyzing the internal network structure of the cluster, the paper analyzed the main factors for the establishment of cluster risks by taking the new perspective of network theory, and analyzed the internal mechanism of cluster risk transmission and diffusion.

The creation of cluster risks are normally due to internal factors and external strength, i.e. endogenous risks and exogenous risks (Zhu Ruibo, 2004). Endogenous risks refer to the accumulated risks due to the internal strength of industrial cluster, including network risks (Cai Ning, Wu Jiebing, 2002), self-fertility risks (Wu Xiaobo, 2003) etc., mainly taking distributed nodes within the cluster network as studying point, and taking the enterprises within the cluster and the relationship among enterprises as studying objects, to study the endogenous risks caused by micro individual enterprises within the cluster. For instance, Lazerson (1999) studied the changes of core enterprises grown from suppliers and the roles in pluralism of the cluster, in the evolution rules of the cluster structure, and pointed out that the orientation of suppliers' strategic capacity must match the strategic relationship network of the cluster, otherwise it will be detrimental to the sustainable development of the cluster economy. Cristina^[3] further analyzed the roles of core enterprises in production chain, capital chain, technology chain and management overflow effect, effectively put forward the evolution of the cluster, and pointed out that the lack of functions of the enterprises may be caused by cluster risk^[3]. Exogenous risks are the risks resulted from the external strength of the industrial cluster, including structural risks and cycling risks (Fritz, 1998). The macro entity of the cluster is taken as study object, and the fluctuation of external general economy (cycling risks) and the products' life cycle within the cluster (structural risks) is taken as studying points, to mainly analyze the influence of risks to the generality of all enterprises within the cluster, and further study the the cluster, e.g. Fritz et al studied the risks caused by the fluctuation of external economy, and Dalum (2002) et al, based on Porter's technological discontinuity theory, took the cluster of wireless telecommunication tools as an example to empirically study how the life cycle of generic technology of the enterprises within the cluster makes the cluster break down and lose competitiveness.

Cross level analysis model of cluster risk transmission and diffusion

Micro level : enterprise network capacity

Håkansson (1987) is the first person to put forward the concept of enterprise network capacity, mainly from the perspective of external network relationship treatment. He put forward the concept of enterprise network capacity, i.e. the capacity of enterprises in improving their network location and the capacity of dealing with individual relationship. After that, since Prahalad and Hamel (1990) introduced the "core capacity" of enterprises to the field of management research, the discussions on enterprise capacity have always been the hot spot of scholars' research (Carlsson & Eliasson, 1991; Rasche & Wolfrum, 1994). Capacity is usually interpreted as the concept with potential, authority and enforcement of the enterprises in a series of process or activities (Day, 1994). To interpret the concept of capacity, the actual research not only needs to understand the composition of the network, but also needs to analyze from the perspective of network structure (i.e. Analyzing how these enterprises get linked)^[4].

Network management capacity

It includes network's long-term planning capacity and core network management capacity. First is network's long-term planning capacity. Håkansson and Lundgren (1995), Lundgren (1995), Mazet et al (1995) took the perspective of network evolution and network treatment as the perspective to study the network's long-term planning capacity. Long-term planning capacity is an organized learning construction. In this process, the cluster enterprises make plans for the current and foreseeable network behavior through network structure, in order to better realize this organized study (Sinkula et al., 1997; Dubois, 1998). Second is core network management capacity. Mattsson (1985, 1987), Håkansson and Eriksson (1993), and Blankenburg (1995) separately studied network management capacity from network location, production management and regional cultural background.

Combined management capacity

It includes the combined management capacity of the whole network and the relationship management capacity of individual enterprise. In the first place, combined management includes two basic levels, i.e. combined management from strategic level which refers to that the integrated distribution of strategic resources are focused on key customers; combined

management at operational level refers to the management to main customer types (Storbacka, 1997). In the second place, relationship management capacity, i.e. the capacity of dealing with relationship among enterprises. It selects suitable objects for cooperation in the network, applies the resources of the cooperative objects, and manages the relationship with cooperative objects (Kristian & Aino, 1999).

Network relationship management capacity

Ritter(1999), from the perspective of relationship management, analyzed the network capacity, and applied network capacity in the research of the whole cluster network structure. Network competency refers to the capacity of enterprises in dealing with relationships, including the competency of professional capacity and social eligibility (Helfert, 1998); in terms of network structure, social skills are the basis of network structure establishment, and professional skills are the component factors of network structure. Network enforcement capacity includes single-dimensional relationship enforcement (Hallen et al., 1991) and multiple-dimensional enforcement (Koontz & Donnell, 1984; Olsen & Ellram, 1997); thus, in terms of network structure, single-dimensional relationship enforcement is the key to manage the relationship among enterprises within the network, and multiple-dimensional enforcement is to manage the relationship of the whole network. (Mattsson, 1985).

Based on the above analysis, given that different scholars made different definitions of enterprise network capacity, the constructions of enterprise network capacity are varied. Upon summarizing the researches by predecessors, the paper summarized the enterprise network capacities into three dimensions of network planning management capacity, network setup management capacity, and network relationship management capacity, which are as follows :

Meso level : the relationship between network capacity and network structure

The relationship between enterprise network capacity and network structure has always been an disputable topic among the scholars. Some scholars believed that cluster network controls other enterprises within the network by "strategic network relationship", and some upheld that the network structure composed by cluster enterprises is a complicated self-adaption system (Easton et al., 1997), in which cluster enterprises does not simply control and influence the remaining enterprises through resources (Hakansson & Ford, 2001; Wikinson & Young, 2002), and there are some other "invisible hands" affecting the enterprises in the whole network (Hakansson, 1987).

Network planning management capacity and network structure

Network planning management capacity refers to the capacity of enterprises in managing standard differences, with strategic planning capacity (Möller & Halinen, 1999)^[6], the enterprises can establish group standard and shared value system among the network members. This capacity of the enterprises includes planning, organizing, distributing and controlling capacity (Ritter & Gemunden, 2003; Ritter et al., 2002), of which planning represents the overall planning capacity of the enterprises to the cluster, and it requires standard management to different members of the network in order to enable enterprises to gain best performance. According to the structural theory of Burt (1992), enterprises establish standards or working process that can be accepted by the other side by planning and setting up rules and regulations, develop management mode compatible with the other side, reduce negative influence raised by different organizational background and organizational culture, and enable the enterprises to be in the central position of the network structure. In this sense, the higher the enterprises' network planning management capacity, the higher the centralization of cluster network structure. Ritter (1999) upheld that the planning capacity of enterprises include internal adaption capacity (to be specific, it includes resources, the weakness and strong-ness of the enterprises, etc.), and network adaptation capacity (to be specific, includes the matching between attribute characteristics of the network and the enterprises' internal resource, the matching between strategy and resources and the inside of network) and environmental adaptation capacity (to be specific, it includes the adaptation of external market and technological development, etc.). On this basis, the enterprises apply network planning management capacity, to effectively coordinate the relationship among the enterprises, effectively distribute resources and personnel (Ritter, 2003), and manage strategic network capacity (Hagedoorn et al., 2003), set up network, select suitable network cooperators, enable enterprises to maintain relatively long-term cooperations and exchanges with partners, and establish shared values and standards.

Network setup management capacity and network structure

Network setup capacity is the capacity of linking management with cooperative partners. With this capacity, enterprises can raise innovation capacity and relationship risk treatment capacity (Gilsing et al., 2005). To be specific, it includes the capacity of managing partners' linking scope, i.e. applying discovering and evaluation methods to select the capacities of partners (Hagedoorn et al., 2006), screening and attracting valuable enterprises, enabling enterprises to possess enough partners and rich links, and raising the centrality of the network (Fang Gang, 2009). Cluster network structure management (Coleman, 1988) is to raise the network setup capacity by managing the number of linked core enterprises, linking distance and linking mode (Freeman, 1979), to enable the sharing of recognition, knowledge, values and code of conduct within the cluster (Gilsing, 2005). Yen and Helena (2009) upheld that enterprises choose linking behavior with high network by raising network setup capacity, which can promote the establishment of social code of conduct, social control, alliance and social reputation. Under the situation of environmental uncertainty, this mechanism is beneficial to the formation of explorative innovation of the cluster (Nooteboom 1999), and beneficial to the uplifting of innovation performance of the cluster enterprises (Ritter & Gemunden, 2004), and raise the competitiveness of the cluster. Cluster's network structure is

composed of both cluster enterprises and surrounding enterprises (Borgatti & Everett, 1999). A great number of researches upheld that the formation of cluster's network relationship can strengthen the competitiveness of cluster enterprises (Porter, 1998; Chiu & Wuehrer, 2006), and the effective relationship linkage among the enterprises within the cluster can enable the enterprises to easily gain knowledge. Madhavan et al (1998) and Nooy et al (2005) upheld that by applying network setup capacity, the cluster enterprises can effectively adjust the relationship with other enterprises in the network, forming favorable network structure (Gilsing, 2005) and network location (Ritter & Gemunden, 2004), and successfully realizing innovation goals and innovation performance.

Network relationship management capacity and network structure

Network relationship capacity refers to that the enterprises within the network select suitable cooperation objects, apply the resources of the cooperation objects, and manage the relationship with cooperation objects (Möller et al., 1999), and it's upheld that the management of internal network of the enterprises (cooperation objects) is an important factor to successfully realize the network relationship management. Ritter et al (2002) upheld that network relationship management capacity exerts positive roles to enterprises' performance. By intimate and orderly cooperation on material, capital and information among the partners, the relationship management strengthens the relationship behavior orientation (Gert & Peter, 2009), raises the centrality of cluster network, and exerts positive influence to enterprises' performance. Relevant researches have been done by Walter (2006), who analyzed the cluster network of 191 enterprises, and upheld that some enterprises within the cluster play the role of "relationship keeper", effectively solving the disputes among the enterprises by sustaining the relationship among these enterprises, and speeding up the knowledge transmission. The higher the relationship management capacity of the enterprises is, the stronger the enterprises' position in the cluster, and the higher the network centrality of the cluster. The network relationship management capacity manages the coordinated activities and mutual adapting capacity among the partners, as a capacity of managing linkage intensity (Ritter, 1999), i.e. establishing and maintaining linkage with proper intensity and thus forming strong relationship and weak relationship in the network. This capacity is the key to determine the degree of profit-gaining of the enterprises in embedded network (Granovetter, 1973; Hansen, 1999). Helfert and Vith (1999) upheld that the design of relationship among suitable partner groups is the key to partner relationship management capacity, and by interviewing 230 senior managers of French and German companies, they noticed that the increase of groups' relationship management capacity can effectively improve the potential relationship among the partners, raise the adaptability capacity among the partners, and strengthen the overall competitiveness of the network.

Macro level : relationship between network structure and cluster risk

The robustness of cluster risks is the representation of clusters' anti-risk capacity. From the logic of the paper, the severer the risks encountered by the cluster, the stronger the destruction of risks to cluster network structure, and thus leading to weaker robustness of the cluster risk (i.e. lower anti-risk capacity of the cluster). On this basis, the paper studied the robustness of cluster risks from two attribute indicators of network structure, i.e. centrality of the network and the intensity of the relationship.

Network centrality and robustness of cluster risk

In network structure, the mutual linkage among the enterprises is applied to represent the communication mode of network enterprises, and the attribute and linkage mode of network structure is an effective indicator to depict the behavior of cluster enterprises (Burt & Janicik, 1996). In terms of the measurement of network **linkage** parameters, current researches are mostly from the perspective of network centrality (Degree Centrality) (Freeman, 1979) and network centricity (Coreness) (Borgatti & Everett 1999). The network centrality is the indicator to measure the overall network structure of the network. Current researches indicate that the higher the network centrality, the higher the reliance degree of cluster members, and the lower the similarity degree among the enterprises (Piore et al., 1984, Scott et al., 1990, Saxenian 1994, Freeman 1995, Lozano et al., 2007). The enterprises select the linkage behavior with high network centrality, which is beneficial to the establishment of social code of conduct, social control, alliance and social reputation (Coleman, 1988). Given the environmental uncertainties, this mechanism is beneficial to the formation of explorative innovation of the cluster (Nooteboom 1999, 2004a). Yet, even though high network centrality can bring positive innovation incentive, it can still bring cluster risks. The increase of number of enterprises linked with focal enterprises can increase the cost of transfer of enterprises (Nooteboom, 1999, 2002). At the same time, high cluster network centrality means high reliance of the enterprises, and thus making the cluster risks easily transmit and diffuse through focal enterprises.

Relationship adaptability and robustness of cluster risks

The strong relationship established among enterprises can transmit high-quality information and tacit knowledge; Coleman (1998) studied the strong relationship from the perspective of credit and trust among the enterprises, and upheld that strong relationship is beneficial to the self-constraint of enterprises, and can effectively promote the cooperation among the enterprises. Rowley (2000) further upheld that strong relationship can strengthen the trust among the enterprises, avoid the occurrence of opportunism among the enterprises, and thus reducing the conflicts among the enterprises, exerting benefits to the establishment of the atmosphere of mutual communication and friendly cooperation among the enterprises, and promoting the establishment of alliance among enterprises in the cluster (Kale, 2002; Heimeriks, 2004)^[5]. Yet, strong

relationship can easily make the enterprises form locked response and route dependence (Grabher, 1993). However, current researches on weak relationship reflect the fact that weak relationship is beneficial to the attraction of new members, extend enterprise network, and realize the exchanges and linkage of cross-order organizations (Granovetter, 1973). Selecting a suitable weak relationship in proper time is beneficial to save time and resources (Burt, 1992), and beneficial to get access to and absorb more divergent information. Thus, weak relationship is less likely to be restrained or restricted by the relationship network, and is beneficial to enable the actors to keep independence and beneficial to the risk transmission and diffusion among the enterprises.

CONCLUSIONS

The literature review in the paper firstly studied the basic theories of cluster and cluster risk, analyzed the key roles of focal enterprises and network structure in cluster risk, and interpreted the internal mechanism of cluster risk transmission and diffusion from three levels of micro-level, meso level and macro level, based on the summarization of current theories on cluster risk evolution, providing sound basis to further studying cluster risk.

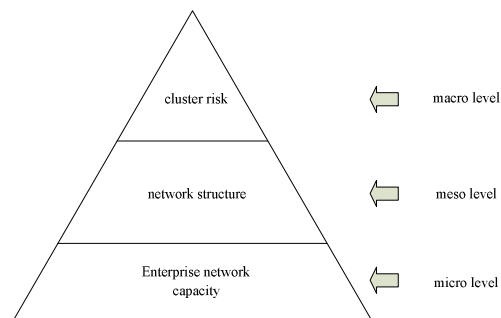


Figure 1 : Structure chart on cross-level analysis model of cluster risk transmission and diffusion

At micro level, the paper analyzed the mode of action and objects of action from three dimensions of the network capacity of cluster enterprises, i.e. Network planning management capacity, network setup management capacity, and network relationship management capacity, thus effectively distinguishing the differences of the clusters with risks (some are imposed on individual enterprises, and some are imposed on most of the enterprises in the cluster).

At meso level, the paper constructed the relationship model between network capacity and network structure, and upheld that the internal network structure of cluster is composed of the relationship between nodes represented by the number of enterprises in the cluster and the lines represented by the relationship among the enterprises. The relationship between network capacity and network structure is to show the clustering of different individuals, the nonlinearity and the mutual effects by these nodes and lines, and make illustrations by distribution control, information sharing, knowledge transmission and learning, multiple characteristics of action, innovation capacity and the complicated relationships and evolutions among individuals. (Auyang, 1998; Holland, 1995; Lane, 2001).

At macro level, the paper interpreted the relationship between network structure and the robustness of cluster risk from the two dimensions of network centrality and relationship adaptability. In fact, the cluster risk transmission and diffusion is a function of time, and the risk transmission and diffusion is definitely accompanied by the evolution of network structure caused by the internal and external environment changes of the cluster. The paper studied the influence of network structure on cluster risk from the levels of enterprise network capacity (micro-meso-macro level), and constructed the cross level analysis model of cluster risk transmission and diffusion.

ACKNOWLEDGEMENTS

This work was financially supported by the National Natural Young Science Foundation of China (71303209), the Zhejiang Science Foundation of China (LQ13G030003).

REFERENCES

- [1] M.E.Porter; Cluster and the New Economics of Competition. *Harvard Business Review*. **10(11)**, 77-90 (1998).
- [2] G.Tichy; Are Today's Clusters the Problem Areas of Tomorrow? *Competence clusters*. Workshop report, Graz: Leykam, 94-100 (1997).
- [3] B.Cristina; Industrial Clusters, Focal Firms, and Economic Dynamism: A Perspective from Italy. Working Paper for World Bank Institute, **124**, 1-18 (2001).
- [4] T.Ritter, H.G.Gemunden; The Impact of a Company's Business Strategy on Its Technological Competence, Network Competence and Innovation Success. *Journal of Business Research*., **57(5)**, 548-556 (2004).

- [5] P.Kale, J.H.Dyer, H.Singh; Learning and Protection of Proprietary Assets in Strategic Alliances: Building Relational Capital. *Strategic Management Journal*, **21**, 217-237 (2000).
- [6] K.K.Möller, A.Halinen; Business Relationships and Networks: Managerial Challenge of Network Era, *Industrial Marketing Management*, 28-49 (1999).
- [7] J.Hagedoorn, M.Cloudt; Measuring Innovative Performance: is There an Advantage in Using Multiple Indicators? *Research Policy*, **32**, 1365-1379 (2003).