

Effective Construction of Collective Learning Mechanisms in Hi-Tech Industrial Clusters

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Abstract Collective learning in hi-tech industrial clusters helps the expansion of the knowledge base and the competitiveness improvement of the whole cluster. This paper analyses the approaches of collective learning which includes the personal flow, the interaction with upstream and downstream enterprises, the derivation of enterprises and the informal communication, states the connotation and characteristics of the collective learning mechanisms, constructs a model of the mechanisms of collective learning in hi-tech industrial clusters. To ensure the cluster vitality and gain benign dynamic development of overall cluster, the cluster members should build effective ways of collective learning based on their own characteristics and locations in the hi-tech industrial cluster.

Key words Hi-tech Industry; industry clusters; Collective learning

1 Introduction

Since the 1990s, lots of literatures on the learning mechanisms of industrial clusters have appeared. The great majority of research objects are concentrated hi-tech clusters in European and American. Economic geographers regard that the exchange of knowledge is an important factor of cluster performance, and it has long been accepted that knowledge has important impact on the competitive advantages of a single enterprise. Because of the network and regional of the industrial cluster, formal and informal interactions between cluster members often is a major feature in the industrial cluster and provides convenience for the intraorganizational learning within the cluster. Compared Silicon Valley with Boston Route 128, (Saxenian 1994) believed that politic, society, institution and non-economic factors are important to the cluster collective learning. (1998) regarded that the formation of a dynamic industrial cluster by collective learning is the result of many factors. The geographic approach, industry specialization, and enterprises assembling are basic conditions, the stable linkages between SMEs and stable local labor market can guarantee the industry specialization. On this basis, the similarity of culture and organization assembles enterprises, and in turn, a strong and stable creative synergy between local employers and labor will generated by the trust which comes from contacts between assembling enterprises, thus collective learning can be carried out, tacit knowledge can be spread and a collective learning environment can be built in real sense in industrial clusters. (Wei Jiang, Wei Yong 2004) held that there are three levels of knowledge interactive network in industrial clusters. Carbonara 2004) discussed that three different types of clusters learning mechanisms includes learning by doing, geopolitical learning and interactive learning. These learning mechanisms in different types of clusters are different.

2 The Collective Learning Mechanisms in Hi-Tech Industrial Clusters

2.1 The approaches to the collective learning mechanisms in hi-tech industrial clusters

Collective learning mechanisms in industrial clusters are the main channels and action modes of knowledge flows between various subjects within cluster and between subjects within cluster and outside cluster. Collective learning within the cluster system is in four main ways: personnel flows, contacts between upstream and downstream enterprises, enterprise derivations, and informal contacts. Frequent personnel flow is the main characteristics of hi-tech industrial clusters based on SMEs. (1) It is inevitable that high-quality talent flows because of shorter life cycle in hi-tech industrial clusters. (2) Professional talents can only flow within the cluster because of fewer job opportunities outside the cluster. The interaction with suppliers, vendors (consumers) is an important means of knowledge transfer. This kind of knowledge transfer based on the long-term trust is not just a static effect of reducing transaction costs, but a dynamic strategy reducing uncertainty which is based on the long-term performance. Non-enterprise organizations (financial institutions, chambers of commerce, training organizations, trade associations, local governments and intermediary organizations) also play an important role in collective learning of hi-tech industrial clusters. There are several kinds of enterprise derivations: (1) the original employees create new enterprises; (2) the original founders leave and start

new businesses because of different management concepts; (3) public research institutions and agencies establish new enterprises. In addition to the official communication, the geographical proximity is favorable to knowledge spillovers through informal channels.

2.2 The contents of collective learning mechanisms in hi-tech industrial clusters

With collective learning, cluster members in hi-tech industrial clusters can absorb the knowledge coming from other members to increase their knowledge base and improve their own ability. Because the collective learning in hi-tech industrial clusters is a complex process, good collective learning mechanisms need to be built in order to ensure the effective cluster learning. The collective learning mechanisms in Hi-tech industrial clusters include dynamic mechanism, knowledge flow mechanism, knowledge sharing mechanism, organized personnel education and training mechanism and related environmental and technological environment (as shown in Figure 1):

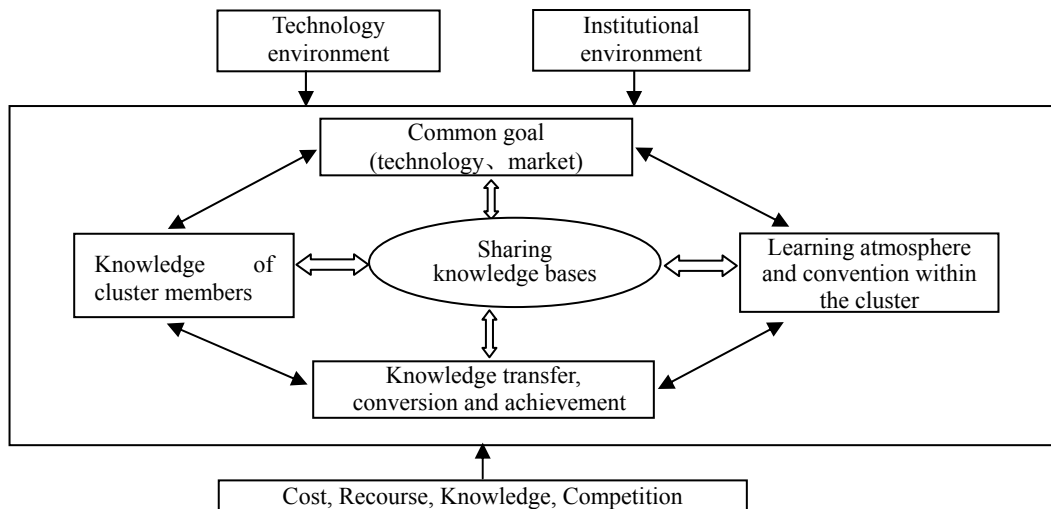


Figure 1 Collective Learning Mechanism in Hi-tech Industry Clusters

1) The dynamic mechanism

The dynamic mechanism of collective learning includes the common goal, the cost reducing, the resource sharing and the knowledge acquisition. The collective learning is aimed at coordinating the cluster members and easily solving the technical, market and other problems. The property of technological goods determines the cluster members in hi-tech industrial clusters should take the collective learning mode to communicate and trust each other, share risks and interests. The characteristics of inter-organization and regional embeddedness of the hi-tech industry cluster may save transaction costs by collective learning. The embeddedness has two forms: one is the mutual trust among the cluster members; the other is the abundant information. The enterprises assembling makes information more concentrated. Although the cluster enterprises have their own specific resource advantages, any enterprise do not possess all the resources completely to effectively solve problems. With collective learning, they gain the complementary resources which combine their superior resources and core competences. This kind of combination greatly enhances the efficiency and ability of collective learning in hi-tech industrial clusters.

2) The knowledge flow mechanism

The knowledge flow mechanism is how knowledge transfers, converses and spreads among cluster members in hi-tech industrial clusters, namely, that is the collective learning process. The knowledge transfer is the flow of their own knowledge among cluster members. The knowledge conversion is the interaction and creation activities between cluster members, which expand the knowledge base in this hi-tech industrial cluster. The knowledge achievement is the shift of the converted and newly created knowledge from the knowledge base to all cluster members.

3) The knowledge-sharing mechanism

The knowledge-sharing mechanism is to establish the sharing knowledge base within hi-tech industrial clusters on which the knowledge can be shared easily and the collective wisdom can be made use of to improve the emergency ability and innovation competence. The sharing knowledge base is the core around which all the learning activities are undertaken. Each cluster member will inject its

knowledge into this system, and draw it to increase its knowledge accumulation. As a result, it collaborates with other members in solving problems and enhances its own capabilities.

4) The personnel education and training mechanism

The collective learning is ultimately carried out by man. The explicit learning mechanism of the organized talent education and training improve the staff knowledge and skills and transport more talents to hi-tech industrial clusters.

These mechanisms and factors of collective learning are interrelated and interacting. Good technology and institutional environments are necessary to the formation of collective learning mechanism. With an encouraging atmosphere, out of the common goals, such as cost, resources, knowledge and competition, the cluster members learn, absorb, transform and innovate the whole knowledge system of the cluster members in accordance with the cluster-specific learning processes and rules, so that the overall hi-tech industrial cluster develops along with the cluster members. In the collective learning, not only technical knowledge, but also management experience and ability spread and flow. The establishment of collective learning mechanisms is a process of constant development with path dependence whose establishment and normal operation can form learning abilities which are difficult to imitate for other clusters, while helpful to enhance the competitive advantage of the hi-tech industrial cluster.

3 The Characteristics of Collective Learning Mechanisms in Hi-Tech Industrial Clusters

The collective learning mechanisms in hi-tech industrial clusters is the flow of knowledge through the network among cluster members and it increases the amount of knowledge by interactive learning to meet needs of respective or common innovation and development. The characteristics of collective learning mechanisms in hi-tech industrial clusters are as follows:

1) It is based on specific network of industrial clusters and promotes the development of this cluster network. Hi-tech industry clusters include different types of organizations such as enterprises, intermediary organizations, universities and research institutes. Once the cluster establishes, these different types of members make it obtain unique advantages which will produce attractive effects, namely, not only exterior enterprises or other organizations continuously enter the cluster, but also new enterprises constantly derive, so the cluster expands its scale and enhance competitiveness. Geographical proximity, production association, cultural embeddedness and close contact between cluster members and frequent communication form close network relationships. Not only is this kind of network relationships the precondition of collective learning mechanisms in hi-tech industrial cluster, but also the formation of collective learning mechanisms further promote the development of network relationships.

2) It is interactive learning and the dynamic flow of knowledge. Cluster members solve problems more efficiently by coordination and interaction, knowledge flows and diffuses with socialization characteristics in the cluster, which are not subject to individual behavior of cluster members, but to the internal cultural and network of the cluster. The knowledge spillovers of the hi-tech industrial cluster by collective learning mechanisms improves the learning and competitive competence of the whole cluster system.

3) It is based on the availability of learning resources in hi-tech industrial clusters, mainly in talent and technology. High-tech industrial clusters attract talents to the same place, which is easier to get talent for cluster enterprises, and all kinds of talent are more likely to seek employment in industrial cluster region where more and more selection opportunities and challenging work are. From the point of view of technology, complete and centralized industrial system strengthens research measures and rapid response of new knowledge and knowledge spillovers also makes it easier for industrial enterprises to obtain the relevant knowledge.

4 The Construction of Collective Learning Mechanisms in Hi-Tech Industrial Clusters

4.1 Improving the learning ability of cluster enterprises

Cluster enterprises are the principal part of collective learning of which the key factor is to strengthen learning ability of the cluster members.

Improving the learning ability includes the self-learning ability of cluster members and the cooperative learning competence between cluster members. The self-learning ability covers the ability

to understand and evaluate the external new knowledge, to digest and absorb new knowledge and to apply new knowledge to innovation. Cluster members reinforce knowledge learning and knowledge accumulation, improve the knowledge base and structure, and enhance the ability to internalize external knowledge. The enterprises in hi-tech industrial clusters should set up the system to transfer and processes internal knowledge, establish internal learning organization in order to implement knowledge sharing, digesting and integrating within enterprises, encourage the internal staff and team to practice and "trial and error" continuously, by which they can accumulate experience to innovate more and more.

(1) Cooperative learning competence is the ability to interactively learn among cluster members. Cluster members generally have the basic knowledge associated with the new external knowledge, need make better use of cluster environment, fully contact and exchange with members around, and strengthen cooperation on the basis of full trust in one another in order to progress in common in the course of cooperation. The cooperative learning can be implement by conscious coordination of equal entities or by spontaneous tacit in the cluster corporative network in order to acquire mutually benefits.

(2) Improving cooperative competition. Cooperative competition between cluster members is to help one another in the process of competition, constantly contribute their core competencies in order to make mutual progress and obtain help and improve themselves quickly, as well as develop more intimate relationship among cluster members. Cluster members are still different individuals who have their own goals and interests, so the course of forming cooperative competition is a long-term and difficult process. Cooperation competition competence among the cluster members is the key to building collective learning mechanisms.

(3) Locating a reasonable position in the cluster. The prerequisite of collective learning mechanisms is to locate reasonably for cluster enterprises. According to their resources condition and the position of other enterprises, cluster enterprises may choose the suitable production units in the cluster production system, and select the appropriate product segmentation market in vest production units.

4.2 Improving the function of cluster agencies

Cluster agencies, including trade associations, entrepreneur associations, professional associations, industrial clubs, mainly are responsible for coordinating activities to develop the innovative systems in the whole hi-tech industrial cluster and exercise the function of guidance, supervise coordination and so on, which has special significance to the innovation network and the development of the overall cluster. Through continually improving the cluster agencies, it provides an excellent opportunity for exchanging information and communicating technology among the internal members in hi-tech industrial clusters. The cluster agencies can do as follows:

(1) Create cluster learning atmospheres. The effective collective learning mechanisms need support by strong learning atmospheres in which the cluster enterprises involuntarily draw attention to learning knowledge. The cluster agencies can build knowledge-sharing platform to facilitate learning communication and information sharing among cluster enterprises, lead a healthy cluster culture, encourage the concept of competition and cooperation and actively promote partnership between the cluster members.

(2) Develop and integrate learning culture. Learning culture has an important influence on collective learning. An important task of collective learning management is to develop and integrate learning culture in the hi-tech industrial cluster, among which the advocating of the senior leaderships of the cluster enterprise has special significance because they make an example of learning and drive the subordinate staff to learn knowledge actively. The learning atmosphere of the entire cluster will also affect the cluster members to gradually form the cluster learning culture whose formation is a long process in which the implementation of enterprise seniors and trade associations is critical.

(3) Help cluster enterprises build learning links with external knowledge sources. The methods include searching for learning objects and the negotiations of learning projects, strengthening the firms in cluster and upstream supply and international market, and promoting the dialogue and the mutual assistance and cooperation between cluster enterprises and with the industry.

4.3 Enforcing the role of the cluster public service agencies

The cluster public service agencies refer to the entire independent organizations which provide technical support, information, management and finance services for the cluster enterprises, Mainly including knowledge center organizations (such as universities, research institutions, etc.), information and management services organizations (such as information service centers, job market, training center, etc.), financial services organizations (such as banks, venture capital institutions, etc.). The roles are as follows:

(1) Providing knowledge services. The public service agencies such as universities and research institutions play a very important role in providing technical and management support in addition to providing personnel training and educational support to the cluster member companies, and become the knowledge infrastructures of cluster inner innovation system and the channels of collective learning in hi-tech industrial clusters. Information and management service organizations can collect information for the cluster, establish platform for the interpersonal communication, promote knowledge diffusion within the cluster, organizations, organize personnel trainings and enhance the learning and innovative consciousness. Financial service institutions can help the cluster members to collectively learn financing and provide investment advice and management guidance.

(2) Increasing mutual exchanges. The interactions between public service agencies and cluster members are essential for the collective learning in hi-tech industrial clusters. With technology diffusion, local universities and academic institutions not only provide technical support for the cluster collective learning, but also transfer science, basic skills and other knowledge through publications. The knowledge-oriented organizations may provide the latest technological development dynamic information to the cluster enterprises and assist them to assess their own technological capability status and gap in order to gear to the expansion learning of cluster members and promote the local incubation of technological achievements.

4.4 Strengthening the guidance of the governmental departments

(1) The government departments can set up cluster talent flow mechanisms, encourage enterprises to derivate, assist industry associations to promote the exchange and communication, promote the tacit knowledge flows midst the cluster members in order to help cluster enterprises to update and expand the basic knowledge.

(2) The government departments can improve the infrastructure which provides good external conditions for the collective learning and convenient communicational conditions for all collective learning subjects in hi-tech industrial cluster. The most important infrastructure in the process of the knowledge is the information network system which promote of learning and accumulation of the explicit knowledge among cluster members. The government departments can provide a platform and create conditions for the communication between cluster members, which promotes technological communication within the cluster innovation system.

(3) The governmental departments can promote the establishment of long-term relationships between cluster enterprises and knowledge central organizations and build a bridge for the cooperation between the cluster members and external knowledge sources.

5 Conclusion

Hi-tech industrial clusters acquire knowledge through collective learning in order to sustain dynamic capabilities and enhance the competitive advantage. Sound mechanisms of collective learning will not only safeguard the individual interests of the cluster enterprises, but also promote the knowledge dissemination within the cluster. The formation and development of high-tech industrial clusters provides a good prerequisite to the establishment of mechanisms of collective learning. To improve the collective learning efficiency, the cluster enterprises improve cooperative learning ability, the cluster agencies consummate service function, the cluster public service sectors play an active role and the government departments strengthen the guidance functions.

References

- [1] Capello R. Spatial Transfer of Knowledge in High Technology Milieux: Learning Versus Collective Learning Processes[J]. *Regional Studies*, 1998,33(4):353-365
- [2] Saxenian A.L. *Regional Advantage: Culture and Competition in Silicon Valley and Route128*[M]. Cambridge, MA: Harvard University Press, 1994:221-227
- [3] Carbonara N. Innovation Process within Geographical Clusters: A Cognitive Approach[J]. *Technovation*, 2004,(24)
- [4] Wei Jiang, Wei Yong. Study on Collective Learning Mechanisms in Industrial Cluster[J]. *China Soft Science*, 2004,(1):121-125 (In Chinese)
- [5] Nonaka I., Toyama R. and Nagata A. A Firm as a Knowledge-Creating Entity: New Perspective on the Theory of a Firm[J]. *Industrial and Corporate Change*, 2000,(9):1-20
- [6] Jing Qinghu, Yu Hongjian. Study on Collective Learning and Influence Essential Factors in Industrial Cluster[J]. *Industrial Technology & Economy*, 2010,(3):133-137 (In Chinese)