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Review and Future Prospects of Research on Innovative Cluster in China and Overseas

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Abstract
The essay summarizes connotation and characteristics of innovation cluster based on the research of scholars at home and abroad from the point of cooperation and linkages, technology and innovation. Besides, it combs the research which is from scholars at home and abroad about the formation mechanism of innovation cluster, and then discusses the current situation of the theory and practice innovation cluster at home and abroad. It is concluded that current research is short of empirical research and existing theory can not efficiently instruct the practice. So the author puts forward his own suggestions and the prospect of the future.

Key words: Innovation clusters; Evaluation system; Quantitative measure

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INTRODUCTION
The Organization for Economic Cooperation and Development (OECD) promotes the thought of "innovation Cluster" in their Research Report Cluster—promoting innovation. Although OECD was the first who published related research results of innovation cluster, it only treated the innovation cluster as a simplified national innovation system, and it can not give the definition of innovation cluster directly. With the development of high-tech industrial clusters such as Silicon Valley and Bangalore, the development mode of "innovation Cluster" is getting more and more recognition and attention from enterprises and researchers. Innovation cluster, which is a paradigm of development, can not only reduce the risk, but also promote the learning and innovation. In recent years, an increasing amount of research production about the "innovation Cluster" has been published; innovation clusters are becoming the focus of government, industry and academia.

1. RESEARCH REVIEW OF INNOVATION CLUSTER
The research for innovation cluster has developed since OCED came up with the concept of innovation cluster in 1999 at home and abroad. Scholars have different ideas on the connotation of innovative cluster. Scholars at home and abroad have continuously developed and improved the concept of innovation cluster during the ten years in which the theory of innovation cluster had further development. The author summarizes the representative points in recent years and divides the points into three categories according to different emphasis.

1.1 Emphasis on High Strength Cooperation and Contact Between the Innovation Clusters
The representative ideas are as follows:

Voyer (1997) thinks that manufacturers, suppliers and service providers of one or more industry gather together in one area or city to share innovation service platform and achievements which is innovation cluster.

Cooke (2002) thinks that the innovation cluster is society relation network which aims to seeking new discovery and making it commercialized.

Humphrey emphasizes industrial cluster embedded features of innovation. He thinks that innovation cluster in essence is innovative industry cluster or industrial cluster based on the innovation. The theory is based on the

perspective of industrial development and has important influence on innovation cluster study in China. The domestic scholars such as Wang Jici and Nie Ming adopt this view in their study.

Meng Xinchun defines cluster innovation from the perspective of dynamic, internationalization, scientific and technology closely, networking and the relation among cluster member.

Konyri thinks that innovation cluster is that different function of enterprise agglomerate in vertical, horizontal and geographic to share knowledge and make the new value-added products.

Wang (2004) accepts the Humphrey's view. He thinks that the innovation cluster is the advanced stage of the development of industrial cluster and industrial cluster is the core reasons and intrinsic basis of innovation cluster.

1.2 Emphasis on Connection on Technology Function

They think more meaningful and more detailed definition of innovation cluster is based on technology function.

Meng (2005) has clearly pointed out that the goal of innovation clusters should include enhancing innovation capability and promoting the commercialization of technological achievements. Of course, innovation cluster is not only a technology system. It emphasizes both technological innovation, and the use of technological achievements, or commercial utilization.

Liyanage (1995) thinks that innovation cluster is network and contact which are formed by the innovation activities being participated in by research institutions and industry.

Botta Gray emphasizes the significant role of technological innovation in innovation clusters. He thinks innovative cluster is new entrepreneurial career based on the new technology commercialization.

Mazzetti and Montresor (2008) think that innovation cluster is a simplified system in which technology flows among internal departments of cluster.

Teng (2008) believes that innovation cluster is from cumulative learning process and scope economy based on the paradigm of discontinuity and complex technology system.

Zhong (2008) stresses the role of value chain and the knowledge chain in the formation of innovation cluster. He defines innovation cluster as technology-economic network with agglomeration economies and a lot of knowledge spillovers.

1.3 Innovation Cluster as a "Creative Industries" Cluster Based on the Perspective of Creative Fields

Scott thinks that innovation cluster should be defined as production and creativity. The notable characteristic of the concept is that the ideas in creative field are far beyond the specific application in the economic field, and the development in the field of culture and the development of science can also help us to understand the diversity of the essence in creative area more or less.

Spear Cape and AOP thinks that the innovation cluster is innovation system composed of multiple elements.

The characters of the innovative cluster are involved when the scholars research the connotation of innovation cluster. It can be divided into the following three characteristics: the dissemination of knowledge, dynamic cycle and cross-industry.

(i) The innovation cluster can spread knowledge and information. Learning from each other and the dissemination of information can reduce the knowledge difference and the asymmetry of information in a certain extent. As Lundvall (1994) emphasized, the character of innovation cluster is learning from each other and acting collectively.

(ii) The innovation cluster is a set of dynamic cycle process. Whether it is technical innovation, commercial technology achievements or both, they are all dynamic cycle process. Technology commercialization certainly promotes technological innovation, and technology innovation can raise commercial level or expand the scope of business which forms a spiral rising trend. Innovation cluster is such a kind of technology-economy dynamic circulation system.

(iii) The connection among the cluster members can be the connection among the various organizations within a single industry, and also can be in different industrial organizations or interaction during innovation process. The research of Voyer (1997) and Broersma (2001) supports this view. Voyer (1997) shows that the connection among the innovation cluster members can take place inside industry and also can be among different industries. Broersma (2001) points out that the key to the understanding of innovation clusters lies in understanding the connection among industries and innovation process. The innovation connection among the same industry is strong link. However, the innovation connection among different industries is weak link (Meng, 2003). Therefore, innovation cluster is a kind of connection among organizations about technology innovation and technology commercialization.

2. FORMATION MECHANISM OF INNOVATIVE CLUSTER

According to Martina Fromhold-Eisebith and Gfinter Eisebith (2004), and the formation mechanism of innovative cluster from the two dimensions (top to bottom and inside to outside) are described as follows:

2.1 The Dimension: Top & Bottom

This dimension reflects the government's role in cluster formation path size.

By government research institutions directly involved in the innovative cluster's innovation research; in different

innovation cluster plays a "character", as in Finland, governments taking ning (Twinning) innovation cluster, is a life science innovation cluster association and the depth of the issuer, is water conservancy innovation cluster agent. From the need of innovation cluster formation, Xiao (2001) believes that government's response to the key technology and common technology innovation activities and policy support of government investment in science and technology vigorously support the development of knowledge services, create conditions of technical communication and knowledge transfer. To strengthen the protection of intellectual property rights, strengthening talents, strengthen the cultural construction of the various kinds of education, science and innovation support. According to the cultivation of national high-tech zone innovation cluster, Ma (2006) proposed the government's policy support key, namely perfect high-tech zone policy priorities, build innovative intermediary service network, vigorously promote collective innovation behavior and construct platform for international services, research, evaluation of innovative clusters and publicity, set up efficient management team.

2.2 The Dimension: Inside & Outside

This dimension reflects that the power of innovation cluster development is from the inside of cluster or outside of the cluster.

This theory is getting more and more attention and the research becomes more popular nowadays and widely identifies two evolution directions as "bottom-up" and "top-down". "Top-down" process patterns corresponds to government driven training mechanism, and "bottom-up" process model corresponds to the market forces driven natural evolution mechanism.

Britt, who is a famous scholar researching innovation thinks innovation cluster is derived from learning process and the scope economy of the paradigm of discontinuity, technology complexity and accumulation. His research lies a solid foundation of the genetic theory research framework of innovation clusters. Some foreign scholars and institutions (such as OECD) continually study innovation cluster under the assumption.

In 2003, based on the research of the dynamic mechanism of the Pacific economic space changes, Parker first emphasized that the effect of knowledge spillover was an important driving force of the formation of innovation cluster.

From the view of the broad transaction cost, Cartel points out that the root cause of the formation of innovation cluster lies in innovation of the decisive position in the enterprise and regional competition.

After an empirical study on the member of the OECDl5, Mazzetti concludes that the formation of the cluster innovation comes from the cluster the establishment of internal technological innovation systems.

In domestic research, based on the theory of economic geography research, Ning Zhongji sums up that the three main formations of innovation clusters: agglomeration economy, knowledge spillover and technological diversity.

Peng (2003) studied the cluster innovation model and emphasized the important role of the overflow ability of the internal knowledge in learning innovation clusters. Chen Yahui believed that the formation of the cluster innovation motivation was highly correlated to the group social capital.

Particularly, Li and Wang (2008) emphasized that the flow of knowledge and interactive learning mechanism played a decisive role in the process of the formation and development of innovation clusters.

From the above studies both at home and abroad, they generally accepts three main driving factors of the formation of the innovation cluster: knowledge spillover effects, gathering economy and technological diversity. At the same time, the knowledge spillover, the social capital and the learning mechanism have been also widely recognized.

At present, the domestic research on innovation cluster evolution mechanism has more representative points of view, which learn from the life cycle theory of technological innovation.

From the aspect of the innovation output, Chen and Wan (2002) divided into innovation cluster life cycle, and pointed out that the indexes of the technical innovation cluster played an important role in technological cluster.

From the aspect of the cluster innovation, Zhang and Liu (2007) analyzed the process of the cluster evolution. And they preliminary set up the path model of the enterprise technological innovation stage of cluster technology evolution and a set of index system.

Teng (2008) stressed that we should provide professional technology research and development services in certain environment of innovation cluster, which is extremely important to the small and medium-sized enterprises in the development of the cluster.

Through the related research, we can know that the study of innovation mechanism of cluster evolution at home and abroad mainly focuses on driving mechanism of cluster innovation, innovation track transition conditions and the formation of innovation system. However, studies are limited to a macroscopic description of various factors of the comprehensive effect. And the literature the system research on the various factors is rare.

CONCLUSION

In analysis, we have made certain progress in the current characteristics of innovation cluster, the research of forming mechanism and evolution. But it is mainly focused on the macroscopically theoretical analysis, and is lack of systematic quantitative analysis. Now it has not yet formed a completely theoretical system. In particular,

the research on innovation cluster has yet to be further in the following aspects.

(a) The present study emphasized that the effect of the technological innovation environment on cluster formation and development. But it lacks of research on system of the influence on the development of knowledge sharing, tacit knowledge spillover, especially technology business maturity and the generalized knowledge diffusion the cluster innovation. Specific performances are as follow: (i) lack of effective technical tool of knowledge spillover effect to measure the development of innovation cluster formation; (ii) lack of studying on the effects of innovation knowledge about externality and knowledge spillover in the process of cluster formation

(b) The changes of innovation cluster space, which are in the economic evolution research, remain to be further researched. There is lack of systematic dynamic mechanism research on the regional distribution and reason of space formation of innovation clusters. Especially, under the background of knowledge economy, knowledge accumulation, overflow and diffusion effect of innovation within the cluster have the spatial discontinuity and adhesion properties. Therefore, it is of great importance to study the dynamic mechanism under the influence of knowledge spillover.

(c) We need to further research the time evolution change of innovation cluster. There is lack of quantitative research in the time evolution law of innovation cluster under the influence of knowledge spillover. Especially, there is lack of analysis of quantitative determination and transition condition of innovation cluster development phase. At the same time, it also has yet to be further studied on the space-time evolution of the synergy mode of cluster innovation, the synergistic effect of cluster innovation, mechanism and influence.

(d) There are more lessons about foreign theories and research results, but less about empirical study on their own home. Although in recent years, our country stepped up investment and support to encourage the development of innovative cluster, provinces and cities also have regarded innovation as the key to support industry and try to guide and encourage. In addition, we have to accept that our country is still in the early stage of cluster development, such as the Zhongguancun's innovation cluster on the development paradigm, which also has the very big disparity from the relatively mature areas such as Silicon Valley and Bangalore. In the situation of the primary development, the innovation of the cluster research in China is still in the stage of exploration. The innovation of the cluster theory is studied with the help of the overseas' related research results. However, in terms of empirical research, there is lack of maturity and a system of innovation cluster development paradigm in our country. There are less research results and no significant effect on the improvement of the theory. Therefore, the theory lags behind the practice development.

(e) The current existing research results play an insignificant guiding role in the development of innovation clusters. Refer to a large number of existing literatures, the writer find that the existing research results are more focused on theoretical aspects, such as the connotation, characteristic, evolution path of innovation clusters, the mode and the macro aspects. But the significance of these studies is concluded more than the guidelines for the practice. The writer seldom sees the research on a certain area. And in the great situation of today's national strongly advocated innovation, the research of innovation cluster for the development of the cluster innovation remains to be strengthened. In addition, the writer hopes that next time the researchers can put a lot of research into experimentation, and make theory guide practice. And we can obtain the biggest significance of the theory.

(f) There is lack of the research of evaluating system and method of measuring the construction of innovation cluster. At present, the domestic rarely find index system and quantitative measures of the innovation cluster. In the process of establishing the index system, there is lack of analysis of its constituent elements and structure of the system and it is not closely to the basic characteristics of innovative cluster. In the process of selecting indicators, it tends to be cautious and unrepresentative. Most of the index system is without a quantitative judgment in terms of feasibility.

To solve above problems about the research of the innovation cluster in China, the authors put forward the following suggestions:

(i) Strengthen the evaluating system of the research of innovative cluster and the method of measurement, in order to more quantitative characterization of the implementation of innovative cluster development. On the basis of qualitative research, we should strengthen the quantitative research with emphasis on the evaluating system and the method of measurement. And through the quantitative research of different regions, different practice of the development of the innovation cluster, we make horizontal and vertical comparative analysis and find out the strengths, weaknesses, gap and weak links of the different times and different parts. Finding out the causes of the different areas of differentiation, we can strengthen the weak link to improve and upgrade, which will really make the research results into practice.

(ii) Strengthen the applied research and empirical research. Theoretical significance lies in the guidance of practice. Therefore, only by guiding the practice can theoretical research have value. In future development, the researchers in our country should strengthen the domestic empirical research of the innovation cluster and make the summary and analysis combining closely with the national conditions and situation of innovation cluster. At the same time, we should draw lessons from advanced theory and experience in foreign. Also, the innovation cluster, which has a certain development in our country,

should learn a successful example in foreign countries. At the same time, the innovation cluster in the initial stage should learn the relatively mature domestic experiences of the innovation cluster.

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