

# Current Status of Technological Innovation Cluster Research

Wenjin Zhu<sup>1</sup>

<sup>1</sup> Wuhan Institute of Technology

Correspondence: Wenjin Zhu, Wuhan Institute of Technology.

doi:10.56397/JWE.2023.06.06

## Abstract

The research on innovation clusters has become the focus of academic research and scientific and technological decision-making of governments around the world. The construction of innovation clusters is of great significance to cultivate strategic emerging industries, enhance regional innovation capacity and promote the transformation of economic development mode. However, at present, the theoretical research on technological innovation clusters is not deep enough, and the theoretical framework is still not clear. On the basis of literature research, this paper starts with the concept of innovation cluster, associates it with technology cluster, and jointly introduces the origin and concept of technology innovation cluster. Based on the analysis of various literature, the shortcomings of the current research on technology innovation cluster and the direction of the next research are pointed out.

**Keywords:** innovation cluster, technological innovation, industrial cluster, technology clusters

## 1. Introduction

In today's world, technological innovation has attracted increasing attention from industrialists of all countries. A new round of world economic competition oriented by technological innovation has begun. Innovation is fundamentally uncertain and needs to be carried out quickly to prevent latecomers from coming closer (and thus gaining potential economic rewards), and the power of "resistance to new approaches" is prevalent in the process of innovation at all levels of society. And innovations are not isolated events and are not evenly distributed over time. Instead, they tend to occur in clusters, or clusters (Schumpeter J A., 2014). Innovations "cluster" not only in certain sectors, but also in certain regions or periods of

time (Porter ME., 1990). How to make use of the innovation cluster phenomenon, the academic community has also done a lot of research on related concepts, such as technology cluster, innovation cluster, industrial cluster. However, the concept of technological innovation cluster is not deep enough. This paper tries to start with the concept of innovation cluster, associate it with technology cluster, and jointly introduce the origin and concept of technological innovation cluster. Based on the analysis of various literature, this paper concludes the shortcomings of the current research on technology innovation cluster and the direction of the next research.

## 2. Put Forward the Related Concepts of Technological Innovation Cluster

Schumpeter (1939) first proposed the concept of innovation cluster. He believed that after the fundamental and latest untested difficulties are overcome, there will be the repetition of the same type of event and the similarity of events in different directions. The first success often produces a “cluster” phenomenon (Schumpeter J A., 2014), pointing out that the first innovation will bring experience to the subsequent innovation. However, whether the innovation can be truly realized remains to be considered. At this time, Schumpeter was more of an analysis, that is, he believed that the overcoming of difficulties is a kind of innovation, and this first innovation will lead to subsequent innovation, thus forming innovation clusters. However, there is no clear four-word concept of innovation cluster. Subsequently, Rosenberg (1976) proposed that the imitation and diffusion of innovation would lead to innovation clusters (Rosenberg N., 1976), and Rosenberg (1984) divided innovation clusters into M-type and T-type. It is more a phenomenon of (“following the trend”), and T-shaped innovation group is the real innovation cluster (the co-diffusion of fundamental innovation or gradual innovation and secondary innovation form an innovation cluster) (Rosenberg N & Frischtak C R., 1984), that is, technology cluster. At this time, the two concepts of innovation cluster and technology cluster coincide.

Hurfbauer (1986) believed that the influence of basic science and technology led to the “technological connection” between innovation, which led to the emergence of innovation clusters and deepened the understanding of the overlap of the two clusters (Hurfbauer, 1986). DeBression C regarded external technical constraints and pressures, internal economic constraints and incentives as the factors leading to innovation clusters (DeBression C., 1989). Yao Zhijian et al. (1999) proposed that the evolution process of technology group structure is a cluster innovation (Yao Zhijian & Wu Han, 1999). At this time, relevant studies attributed the formation of innovation clusters mainly to the circular influence formed by technology itself and the economic effect brought by innovation clusters, which provided a strong theoretical foundation for the formation of related concepts of technology innovation clusters.

However, it is worth noting that for the concept of “technological innovation clusters,” Liu (1993) only took the term as the title in his book *The*

*Economics of Technological Innovation*, without clearly proposing and defining the term in detail. After reviewing relevant literature, it is found that there is not much research on this term in relevant literature. Therefore, there is no detailed definition of the concept of “technological innovation cluster”.

### 3. The Connection Between Industrial Clusters and Technological Innovation Clusters

Wang Jici (2004) pointed out that a large number of industrial clusters that have been formed in China are still in the low-end stage of relying on low cost. Therefore, it is necessary to move from low cost cluster to innovative cluster (Wang Jici, 2004). HAMDOUCH A (2008) believed that innovation clusters are “innovative” industrial clusters (HAMDOUCH A., 2008). Both of them mean that industrial clusters are ultimately needed to become innovative clusters, and industrial clusters are the basis of innovative clusters. By using the theory and method of system dynamics, He Yue et al. (2013) made a detailed analysis of the mechanism of upgrading industrial clusters to innovation clusters, and proposed that in the process of upgrading industrial clusters, the power of universities and research institutes should be fully brought into play, and the core technology level of the industry should be improved through industry-university-research cooperation based on applied research. To provide necessary technical support for the upgrading of industrial clusters to innovation clusters (Yue He & Pinping Hu, 2013). Explain in detail how to form the technological innovation cluster of the industry. Cao Shuoyang (2020) proposed that innovation clusters are based on industrial clusters, composed of enterprises, research institutions, universities, intermediaries and other organizations, which can form an agglomeration economy, exchange a lot of knowledge and skills, and produce new technologies or new products (Cao Shuoyang & Li Tianzhu, 2020). Innovation clusters, industrial clusters and technological innovation should be closely linked.

In recent years, there have been many studies on the relationship between industrial clusters and innovation clusters. But at the same time, most of these studies connect industrial clusters with innovation clusters, and there are few related studies on how to use technological innovation to make industrial clusters transition to technology-centered innovation clusters, that is,

technological innovation clusters, which should not only stay at the level of simple innovation clusters.

#### 4. Concept of Technological Innovation Cluster

Wu Xiaojun and Gao Ruxi (2007) analyzed and proposed the organizational structure model of biomedical innovation clusters by simplifying the industrial organization model and structure of biomedical innovation clusters in the world (Wu Xiaojun & Gao Ruxi, 2007). In fact, the innovation economic system of the whole region is formed by the close interaction between science and technology clusters and industrial clusters under the media and connection of a large number of intermediary agencies and platforms (Mao Lianghu & Zhao Guojie, 2009). In other words, industrial clusters and technology clusters jointly promote the emergence of innovation clusters. In other words, innovation clusters have the attributes of industrial clusters and science and technology clusters, which means that innovation clusters can be cultivated and developed by upgrading industrial clusters or science and technology clusters (Zhong Shuhua, 2009). As Shantha liyanage pointed out, innovation clusters are neither industrial clusters nor “clusters in the field of technology” (LITANAGE S., 2003). Obviously, the essence of upgrading industrial clusters and technology clusters is to add new attributes on the basis of original attributes. Is it reasonable to suggest that technological innovation clusters are not simply innovation clusters or technology clusters, but add the attributes of technology clusters on the basis of innovation clusters, that is, technological innovation clusters are the part of the successful overlap of technology clusters and innovation clusters?

#### 5. Conclusion

Domestic research on technology innovation cluster has made some achievements, and it has also been applied in many industries and regional economic research in the past two years, which has a significant role in some industries and regional technological innovation. Zhang Jinliang (2014) deeply discussed the connotation and characteristics of technological innovation clusters, and found countermeasures and suggestions to improve the continuous innovation capacity of innovative enterprises in Hebei Province in view of the current situation of the lack of continuous innovation capacity of

innovative enterprises (Zhang Jinliang & Li Hejun, 2014). Wei Suohuan (2017) pointed out that the formation of technological innovation cluster is the key to the rapid economic development of Langfang, and it is urgent to accelerate the formation of technological innovation cluster to promote the continuous improvement of scientific and technological innovation ability of Langfang (Wei, S., 2017).

However, there are still many areas that can be studied in the future: on the one hand, the clear definition of the concept of technological innovation cluster proposed by Liu Xioli is still in the blank stage, and it needs to be defined and studied in detail; Second, more attention should be paid to the influence of technology cluster and industrial cluster on innovation cluster, and the authenticity of the proposed technology innovation cluster as the overlap part of innovation cluster and technology cluster should be studied and discussed. Third, in recent years, there are relatively many related studies on industrial clusters and innovation clusters, and the related studies on the influence of technology clusters on innovation clusters are more concentrated and detailed into the influence of technological innovation on innovation clusters, so that the influence on technology innovation clusters can be studied from the related direction of technology clusters. Fourth, the related research on the concept of technology innovation cluster is relatively few and confused. There are some misunderstandings in the distinction and mutual influence of the concepts of technology innovation, technology cluster, science and technology cluster, industrial cluster, innovation cluster and technology innovation cluster, which need to be studied more carefully.

#### Fund Project

This research was supported by the project: Comparative Analysis of Development Status of “Little Giant” Enterprises that Use Special and Sophisticated Technologies in Major Cities of the Yangtze River Economic Belt. Project No.:CX2022305.

#### References

- Cao Shuoyang, Li Tianzhu. (2020). Research on dynamic mechanism of characteristic town from the perspective of innovation cluster: a multi-case analysis. *Science and Technology and Economy*, 33(4), 5.

- DeBresson C. (1989). Breeding Innovation Clusters: A Source of Dynamic Development. *World Development*, 17, 1-16.
- HAMDOUCH A. (2008). Conceptualizing innovation clusters and networks. Forum The Spirit of Innovation III, International Conference, Washington, USA, 14-16.
- Hurfbauer. (1986). Long Waves and Technological Innovation. *Selected Essays on Modern Foreign Economics* (Series 10). Beijing: The Commercial Press, 163.
- LITANAGE S. (2003). Expanding innovation clusters through collaborative research networks. *Technovation*, 15(9), 45-47.
- Mao Lianghu, Zhao Guojie. (2009). Study on Interactive development Mode of Science and technology cluster and industry cluster: A case study of biomedical innovation industry cluster. *East China Economic Management*, 23(04), 45-48.
- Porter ME. (1990). The competitive advantage of nations. *Harvard Business Review*, 68(2), 73-84.
- Rosenberg N, Frischtak C R. (1984). Technological innovation and long waves. *Cambridge Journal of Economics*, 8(1), 7-24.
- Rosenberg N. (1976). *Perspective on Technical*. London: Cambridge University Press.
- Schumpeter J A. (2014). *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*. Martino Publishing.
- Wang Jici. (2004). Policy suggestions on developing innovative industrial clusters. *Economic Geography*, (04), 433-436.
- Wei, S. (2017). *National Circulation Economy*, (20), 62-63.
- Wu Xiao-jun, Gao Ru-xi. (2007). Research on the structural characteristics and operational mechanism of biomedical innovation cluster. *Science of Science and Management of S.&T.*, (08), 59-64.
- Yao Zhijian, Wu Han. (1999). Characteristics of technology groups in technological innovation. *Studies in Science of Science*, 17(3), 6.
- Yue He, Pinping Hu. (2013). System dynamics analysis on the upgrading mechanism of industrial cluster to innovation cluster. *Science and Technology Management Research*, 33(6), 4.
- Zhang Jinliang, Li Hejun. (2014). Improving the continuous innovation ability of innovative enterprises in Hebei Province by technological innovation clusters. *China Economic and Trade Guide*, (14), 13-14.
- Zhong Shuhua. (2009). Analysis of development and growth path of innovation clusters. *Science and Technology Management Research*, 29(10), 400-403.