Knowledge spillover and high-tech industry cluster: A literature review

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Abstract. Knowledge spillover is one of the incentive forces for companies using more expenditure on R&D to shape cluster. This paper summarizes and reviews academic research literature from three aspects, of which contain the connotation of knowledge spillover in high-tech industry cluster, conduction mode of knowledge spillover effect in high-tech industry and explain factors of knowledge spillover effect. This paper devotes by assembling anterior divergent tributaries of works to assist in illuminating on this prosperous research area, based on previous research, and finally it notes that future research needs to pay attention to several aspects.

1. Introduction
High-tech industry cluster is the most important organization in current economic and social development. Knowledge spillover that is one of the main drivers of formed agglomeration benefits is to explain one of the most vital concepts of enterprise cluster. This paper mainly utilizes Internet academic resources revolving both of the knowledge spillover effect and high-tech industry cluster. It adopts key bibliographic method and reviews the relative databases, such as Wiley Online Library, Springer Link, Engineering Village and Web of Science.

2. Connotation of knowledge spillover in high-tech industry cluster

2.1. Knowledge spillover meaning
Knowledge spillover is a transaction of concept, method and theory among individuals and public. Knowledge belongs to a public product with non-competence and externality. Polanyi (1997) mentions that knowledge can be divided into two categories, explicit knowledge and tacit knowledge. Knowledge has three external features as public product. The first one is uncertainty and because knowledge exists in the real world, however, the owner of the knowledge or intellectual has limitations. Second, knowledge obtained from different people in diverse location and on heterogeneity time point holds complement with space and time. Third, because any subject have access to knowledge through mastering, creating and applying. These characters interpret the necessity of knowledge spillover occurrence. Knowledge spillover is a value of intellectual property that is through information exchange and do not or less compensate for the creators. Knowledge spillover is a process through which different subjects interact and communicate and it broadcasts with unconscious during this process.
2.2. Knowledge spillover characteristics of high-tech industry cluster

In knowledge executive economics, knowledge spillover that is in non-rival market has technological advancements through modernization which generally derives from expertness within a high-tech industry. The relationship between knowledge spillover and industry cluster is mutually reinforcing and cumulative cyclic causality. Knowledge spillover prompts industry spatial agglomeration, and spatial concentration improves the economic exchange of thought and consciousness. Feldman and Audretsch (1999) has put forward that spatial concentration declines the possibility of the scientific discoveries and the scientific commercialization and promotes growth of cluster development and innovation output.

As one of the important drivers of high-tech industrial cluster, Chyi, Lai and Liu (2012) has pointed out that knowledge spillover reduces the high technology cost of industrial innovation to a large extent and promotes the strengthening of the high-tech industry cluster. Knowledge spillover of high-tech industrial agglomeration is an organization of high-tech industry knowledge especially tacit knowledge.

Chang, Wang and Liu (2016) proposed that knowledge spillover spreads, transfers and accesses between different organizations and dissemination in the same area. Tacit knowledge determines the high-tech industries tendency of cluster growth on the grounds that high-tech industries with high innovation potential. Relatively speaking, areas owning substantial stock of knowledge have more knowledge absorbing abilities. High-tech industry cluster is much more prone to form innovation clusters, networks and accelerate diffusion and dissemination of knowledge. Thus it will improve innovation ability and realize industry structure upgrading. Therefore, high-tech industry cluster and knowledge spill interaction and strengthening will accelerate the growth of high-tech industry.

3. Conduction mode of knowledge spillover effect in high-tech industry

3.1. Origin of knowledge spillover

Jinji and Mizoguchi (2016) discusses that knowledge spillover always happens in adjacent area. So what is the root of knowledge spillover? There are three respective sources to illustrate the knowledge spillover phenomenon. Knowledge of potential difference refers to a gap between disparate subjects at a fixed time point. This gap causes the knowledge spillover. Although all stock knowledge is freely available and space and time are limitless, the information of specific knowledge is still constrained. There must be knowledge differences in any two individuals for the reason that individual has general differences in capacities, opportunities and conditions, even if they have the same level and stock of knowledge. Knowledge can be obtained through personal channels (including work, social relationships and everyday life). Only some people those who have different knowledge stocks manage to turn knowledge into new inventions or scarce resources, and they develop relatively into skilled workers, scientists, engineers, and so on. These technical person who enter into diverse industries and sectors inaugurate knowledge application and technology innovation. Hence the knowledge of potential difference between sectors and industries is created.

Endogenous economic growth theory concludes that technological innovation is the endogenous variable of economic growth. Superficiality of knowledge spillover and increasing returns scale of knowledge accumulation are two important factors for economic growth. As a productive factor acting on the economic growth, knowledge spillover can cause increasing marginal product of capital. We may assume that other factors are the same and then research and development efforts of the body of economy and innovation differences determine in large extent the gap of economic growth. Economic performance will be improved if industries have access to obtain knowledge without cost on the basis of technological innovation. Therefore, knowledge spillover is the critical ingredient to economic prosperity.

Romer (1994) has said that technical knowledge inputted into production process has significant different with physical capital, such as machinery and equipment inputted into the same process.
Technical knowledge has the public characteristics of non-competition and non-ranked, but it is not a pure public goods. Because of the non-competitive of technical knowledge, it’s hard to avoid spillover effects. Moreover, technology innovation of the knowledge spillover should not be ignored.

3.2. Stage process of knowledge spillover in high-tech industry agglomeration
Knowledge life cycle theory can be used to throw light upon the concept of knowledge generation. Hervas-Oliver, Lleo and Cervello (2017) has put forward that knowledge generation mainly refers to a notion that new ideas and innovations are propagated between people and people, people and enterprises or interactions with external information sources in high-tech industry. Knowledge validation makes reference that publication of new knowledge always goes through a process of accepting, reviewing, testing and approving from other agencies of high-tech industry cluster. After such a long period, it is a previous phase that new knowledge turns into collective knowledge. Subsequently, knowledge synthesis happens. It substantially interpolates a procedure that a transform from new knowledge occurring in industry clusters to integrated knowledge. And this change principally relays on knowledge sharing, transferring, educating and training. Knowledge attenuation of updating refers to knowledge clusters gradually within the curing and storing. Part of it reflecting aging tendency has not adapted to environment changes both inside and outside the high-tech industry organization. Other part gets integrated, updated and added value by spillover and absorptive.

3.3. Knowledge spillover approaches in high-tech industry cluster
Knowledge spillover of high-tech industry proceeds in a variety means. We can divide knowledge spillover into several different ways according to knowledge overflow channel. Liu and Buck (2007) indicates that many scholars classify talent flow that is actors and vectors of knowledge in industry cluster as important ways of knowledge spillover. Relative studies encounter that most manager, engineers and other technical personnel stay in the original region except scientists who live both in the same sector and area or in the same department of different area. Knowledge spillover caused by knowledge and expertise flows in high-tech industry has two kinds. One comes from equivalent talent flow in industry cluster, and the other originates from different regional high-tech industrial agglomeration. China economist, Zhang (2017) discusses that constant innovation pressure and motivation of high-tech industry hail from itself faster upgrading of high returns and product features.

Gathering high-tech enterprises tend to descend low risk of cooperation on research and development, resulting in knowledge spillover and re-engineering. The production-study-research cooperation between researchers in research and development will enable enterprises, universities and research institutes exchange heterogeneous knowledge, based on the research and development of the process or products. General corporate researchers, scientists and research institutions in the university and engineering harbor twin goals that thinking technology subjects will seek to lower costs and high output. In high-tech industry, this decision itself will accommodates high-tech industry agglomeration district effect. Start-up companies will make full use of high-tech industry agglomeration district institutional spillover of knowledge and experience. It certainly finish knowledge creation process in generating new ideas and skills within distinctive groups.

4. Explain factors of knowledge spillover effect

4.1. Environmental factors
Lauren, Fielding, Smith and Louis (2016) emphasizes that environmental factors mainly includes government polices on environment and cultural construction of clusters. In order to overcome failure of knowledge overflow, government takes up policies, laws and regulations by means of intervention in the economy. Also, environmental factors conclude customs, cluster cultures and social capital, path dependence formed by them. These factors are such as cultural blessedness, cognitive trap talk. Policies, rules, customs, and culture not only can reduce the opportunism of clusters in knowledge
spillover, but also can guide the behavior of enterprises. From two aspects of incentive and restriction, environmental factors implement knowledge spillover in the cluster.

4.2. Structural factors
Puškárová and Piribauer (2016) gives priority to structural influence factors that they incorporate knowledge, structure of cluster, absorption capacity, intellectual properties, and they are associated with specific clusters of industry characteristics. High-tech industries possessing rapid technological transform, short product life cycle and product and process innovation performance characteristics, compared with traditional companies, confront more risks. In the process of market competition and speedy operation in science and technology, any one company cannot continue have forever advantages in technical areas. Every step of the innovation of contemporary high-tech enterprises are required to to be supported by external knowledge sources. Providing the basis for technological innovation in high-tech industries, the knowledge spillover effect of industrial clusters make innovation, technology application and the proliferation more efficient and faster.

4.3. Behavior factors
Kuruppuarachchi and Premachandra (2016) highlights behavioral factors which is an appropriate strategic behavior that high-potential enterprises prevent or promote their own knowledge spillover. The main methods are internal (cooperation, vertical integration, asset investment). There is a certain risk for enterprises of knowledge spillover in the reality, especially among competing enterprises. Innovation of competition will make rent dissipation. Imitators using cost advantage to implement price competition may be allowed to get below-average funding return on innovation productivity. Enterprise integration is most effective on external governance countermeasures.

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