

Towards an Innovation Cluster in Indonesia - A Literature Study and Research Agenda

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Abstract

Developed countries has realized the innovation, diffusion and learning processes are believed as key success factors to determine their productivity and those three factors gathering together to generate competitive advantage. Therefore, strengthening the innovation system becomes a very important agenda in many countries and coupled with the phenomenon of business agglomeration or the clustering phenomenon that can be seen around the world. While the concepts of clustering have been investigated for the last twenty years, there has been relatively deficiency of research on the issue of innovation cluster, especially in Indonesia. For that purpose, this paper described a literature review in context of innovation and cluster that emerge in the developed countries and how the development cluster and innovation itself in Indonesia. By analyzing the correspond literature, the best standard of innovation cluster are refined and enhanced. The results of this study contribute as a guide for potential areas for future research.

Keywords: innovation, cluster, Indonesia, literature review, National Innovation System (NIS)

Abstrak

Negara-negara maju telah menyadari proses inovasi, difusi dan pembelajaran diyakini sebagai faktor kunci keberhasilan dalam menentukan produktivitas dan untuk menghasilkan keunggulan kompetitif. Oleh karena itu, penguatan sistem inovasi menjadi agenda yang sangat penting di banyak negara dan ditambah dengan fenomena aglomerasi bisnis atau fenomena clustering yang bermunculan di seluruh dunia. Walaupun konsep clustering telah diselidiki selama hampir dua puluh tahun terakhir, ada

kecenderungan masih kurangnya perhatian pada isu klaster inovasi (innovation cluster). Untuk tujuan itu, riset ini berusaha untuk menggali studi literatur dalam konteks inovasi dan klaster yang muncul di negara-negara berkembang dan bagaimana perkembangan inovasi dan klaster itu sendiri di Indonesia. Berdasarkan literatur yang relevan, kriteria sebuah klaster inovasi dapat disempurnakan dan ditingkatkan. Hasil dari studi literatur ini juga memberi gambaran jelas tentang area yang potensial untuk diteliti lebih lanjut.

Keywords: Inovasi, klaster, Indonesia, studi literatur, sistem inovasi nasional

1. Introduction

1.1. Background

Globalization of markets, vertical integration shift into relying on outside suppliers and partners, no longer geographical boundaries and institutions and the competition of skill intensity and knowledge has led the nations and regions around the world to compete to become the most productive location for business. Furthermore, because of globalization, the world steps into era of innovation in industry. The ability of a nation to improve sustainable economic growth depends on the ability of the nation in improving innovation. Innovation based on the capitalization of product technology research will make an immediate impact on improving sustainable productivity, which in turn can accelerate the economic growth of a nation. That's why striving National Innovation System (NIS) is important because how nations utilize and exploit their NIS is a measurement how nation compete and ride the wind of globalization.

Over the last decade, there has been particular attention addressed to activity of industrial clusters and the co-occurrence relationship to regional development. This trend are frequently defined as the "agglomeration" of companies which is operating in the same group of industry or operating in the same location (Tambunan, 2005). The concept of agglomeration or clustering is part of the innovation systems approach and defined as the reduced form of NIS (Hertog et al, 2001). Clustering is generally defined as "a process of firms and other actors co-locating within a concentrated geographical area, cooperating around a certain functional niche, and establishing close linkages and working alliances to improve their collective competitiveness" (Porter, 2000).

Indonesia is currently in the middle of development process in all fields, especially in industrial development. To actualize this process, it needs contribution from all actors that exist: state-owned, government and privates. Therefore there is a need for synergistic collaboration between different actors to support the strengthening of the innovation system in Indonesia. Besides that strengthening the innovation system is rated as a national long-term development agenda which is very important in Indonesia (in accordance with act no. 17/2007). Given the richness and diversity of the relevant literature, it is hardly meaningful to aim for a clinically precise definition of what makes up a cluster. Analysts and practitioners may appropriately apply different definitions and terminology depending on circumstances and preferences. Bortagaray et al (2000) argue that there is no reliable definition of innovation cluster is and in practice, the term of innovation cluster are seems interpreted with science cities, industrial cluster, incubators, techno parks and networks. Therefore, it is important things to clarify the basic concept of innovation cluster.

1.2. Objective

While the attention paid to the concept of clusters has enhanced its visibility, confusion persists regarding the meaning and applicability of the term. With the growing popularity of the cluster concept especially in innovation cluster and expanding efforts to put the concept into practical use, there is a risk of blurring not only the definition but also the practical implications.

This paper objective is to help the understanding of the key issue and implication of innovation cluster as drivers of National Innovation System. First is to report on the development of an innovation cluster literature in the field of research and practical. The second is to report the development of the emergence of innovation cluster in Indonesia as a developing country. The last is to give the shed of light about how to implement the innovation cluster, from theory to practice.

1.3. Outline

The next section provides definition and discussion about National Innovation System (NIS), industrial cluster and innovation cluster literature. Later discusses how this study conducted and the discussion of study result which refers to the object of this study, the development of NIS in Indonesia and building an innovation cluster in Indonesia. The last section will be the conclusion and future research in the development of innovation cluster in Indonesia.

2. Literature Review

2.1. National Innovation System (NIS)

The term of National Innovation System is the novelty linear model of innovation in science and technology studies, since the come up of linear models such as Information Society, Triple Helix and Knowledge-Based Economy (Godin, 2007). The main objective of this framework is innovation on a national scale and it is supported by a system which consists of several sectors that support each other, ranging from university, industry, government and their environment. The framework also emphasized on the relationship among the sectors and the causal to the performance of the system itself.

The process of globalization has encouraged the involvement in the international competition, markets competition, technologies, expertise, and investment. In this competition, competitiveness are measured by several economic indicators, such as GDP (gross domestic product), trading volume, and the relationships between them, both quantitatively (growth rates) and qualitatively (human resources).

One of the 'measurements' which is very important in determining the competitiveness of a country's innovation is their productivity. Productivity is generally well known as the ability to produce products (goods, services and / or both) from one or more inputs into products or output. In more detail, there are two principal dimensions in productivity, first is dimension of effectiveness that leads to the attainment of targets relating to the quality, quantity and time. The second is related to the efficiency of efforts to compare the inputs are actually used or how the work is carried out. With the larger market chance and the great demands, a great scale of productivity is not good enough but large quantity products, products homogeneous standards, regular supply and good quality and prices became a mandatory requirement to compete in global market.

Globalization leads to complex changes and the dynamic development of science and technology. Development of a nation's innovation system (NIS) is now no longer possible to be implemented if the actors are in isolation and work alone. Therefore, in order to succeed in the development of innovation system, stakeholders must hold and drive improvements of these five factors: linkages, partnership, network, positive interaction and synergy as a "key success factor", it is supported by a series of studies conducted by the Organization for Economic Co-operation and Development (OECD) (1997; 1999), then Freidheim Jr. (1999) and Kautz (2000), and Survey "Trendsetter Barometer" by Pricewaterhouse Coopers (2000 and 2004).

They reveal a better business performance if the companies adopted strategic alliance. Studies conducted in various OECD countries shows partnerships among various stakeholders including developers or technology providers and technology users turned out positive for the performance of the organization or company. Thus, the success of innovations depends on the effective interaction between the source of knowledge and business sector.

Many developed countries increasingly have embraced the importance of networking and forming partnerships between corporate and non-corporate organizations. This is what underlies those countries build a network, interactions, linkages and partnerships in a multi synergistically integrated area. Some examples include Silicon Valley and the Research Triangle (US), the Third Italy (Italia), the British Motor Sport Industry and the Oxfordshire / Northamptonshire (UK) (Andersson et.al, 2004).

These changes also led to a paradigm shift in business practices and the role of government. A similar paradigm shift occurs also in innovation policy (policies to strengthen innovation systems), including the activities of research, development and engineering. In the United States (US), the European Union (EU) and other developed countries, public-private partnership evolved into a model / mechanism that led into encouraging engineering, innovation and accelerate the diffusion of innovations into industrial sector.

Lundvall (2004) argued that NIS is an innovation system which interact in producing, diffusing and using new knowledge and economically useful in a border state. In another part Lundvall also said that the innovation system is a social system in which learning, searching and exploring is the central activity, which involves interaction between people / society and reproduction of individual and collective knowledge through admonishment remembering.

2.2. Industrial Cluster

Nowadays, the paradigm of sectoral view in which too "fragmented" shift into the direction of the cluster approach, for the government who's looking to create regional economic growth and drive innovation, industry clusters are the answer. this term was first introduced by Harvard professor Michael Porter in the early 1990s, This theory stated that the government or policy makers are able to create a hub of economic activity in the form of specific industry sectors by bringing together businesses, suppliers, researchers and several other stakeholders (Wadhwa, 2009). The application of NIS (National Innovation System) is basically consists of several other related systems that are a part or sub-systems, called RIS (Regional Innovation System) (Taufik, 2010).

Simplification shift in the view of the importance of the development / strengthening of industrial clusters in the innovation system concept can be illustrated as in Figure 1.

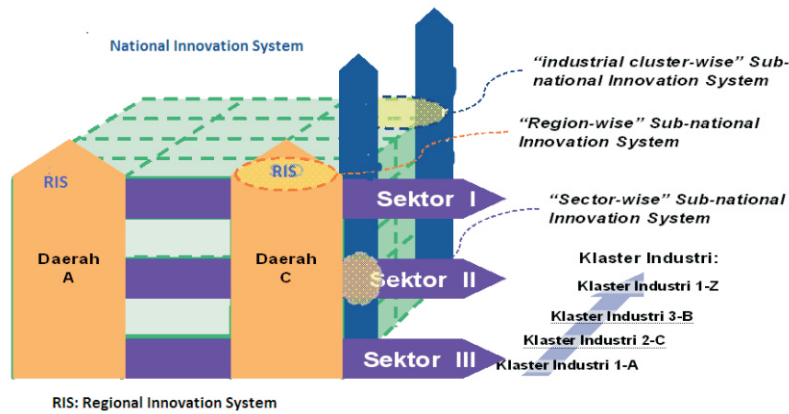


Figure 1. National Innovation System (NIS)
Source: www.dtm.go.id

While a significant literature on clusters has emerged, the definition of cluster is still contested, even Porter has not give the proper definition of cluster, but he has linked the performance of a country in the global economy are summed up in the word of "competitiveness" of the industry cluster. According to Porter, the competitiveness is formed by the interaction of several factors are referred to as national "diamond" (Porter, 1990). Diamond is formed by (1) condition factor, (2) demand conditions, (3) related and supporting industries, and (4) firm strategy, structure and rivalry.

He also includes two context factors related indirectly through: (1) the role of government and (2) the role of chance. These factors dynamically affect the company's competitive position in the country. "Competitive advantage in advanced industries is increasingly determined by differential knowledge, skills and rates of innovation which are embodied in skilled people and organizational routines" (Porter, 1990).

A cluster is defined as "a geographically proximate group of interconnected companies and association institution in particular field, linked by communalities and complementarities" (Porter, 1990). The development of clusters can be used to develop a broad range of industries (broad base) and focused on the types of products that are likely to have a high international competitiveness in the domestic and global markets. Geographic scope of the industry cluster can vary greatly, ranging from one village or one of the roads in urban areas to include a district or province. An industry cluster may also reach beyond the neighboring countries. Or in a brief, definition of cluster is a specific group of business industry connected by a chain of process creation and attempt to increase the value added, either through business or non-business relationship.

Department of Trade and Industry and the English Regional Development Agencies in a Practical Guide to Cluster Development (2010) also mentioned that there are three critical success factors in cluster development, first is networking partnership, second is innovative technology and third is human capital. These three factors are the most important part in measuring success factor in cluster development.

Thus, industrial clusters usually provide the environment, the combination of assets, institutions and knowledge are likely to result the higher levels of innovation than usual. It happens because it will be easier to see the opportunities and develop the idea if the actors were in the middle of the action with a group of leading companies and suppliers that are around (close each other). It is also fostering industrial clusters underlying conditions that enable innovation occurs. Clusters tend to stimulate the growth of skilled labor and the development of knowledge and technology in certain fields. Consequently, if a cluster develops, it will tend to not only produce innovation, but also produce the intellectual capital and technology.

Various innovations phenomenon also shows that innovation is actually a creative and interactive process involving institutions of market and non-market. Research, development, and engineering are very important for the development of innovation. However, innovation requires more than just engineering. On the other hand, although the company is a main actor in the development of innovation, they could not act alone. Therefore, the productive and synergy "crowd" are required for the development of innovation (Taufik, 2007).

2.3. Innovation Cluster

Innovation is generally considered one of the key components of success in the globalization (Arthurs et al, 2009). Developed countries compete to transform themselves into innovation society, where the industry continues to innovate for producing new products based on technologies. Most of the competing countries, like the US and Canada are trying to create a business incubator in each area and trying to connect the local community or academia or university to the business world or designing a science park. And in the States that more advanced with substantial funding towards the development of innovation, they create science cities, such as Japan's Tsukuba or an area such as: Silicon Valleys, Route 128, Research Triangle Park (Gibson, 2005).

Example of the success of an innovation cluster that has a big impact on the economy of the region also for the state is Silicon Valley and Route 128. In analysis of two innovation clusters in US, Silicon Valley and Boston Route 128, Saxenian (1994) stated that both clusters have demonstrated rapid and sustained growth in jobs generated and new companies created and as a matter of effect it give big impact in US economy. The other innovation cluster rising star is Bangalore in India, it attract many high tech cooperation to join in this area (Fallah, 2005). The adequate physical infrastructure and facilitating interaction among the companies become their key success factor in developing an innovation cluster.

Table 1. Data Employment and Establishment of Silicon Valley and Route 128
Source: Saxenian (1994)

Year	High technology employment		Number of High technology establishment	
	Silicone Valley	Route 128	Silicone Valley	Route 128
1950	17.376	61.409	109	268
1975	116.671	98.952	831	840
1990	267.531	150.576	3.231	2.168

Since the middle of 1990, an increasing research effort has been focused to the study of innovation clusters. One of the biggest challenges that arise in the study of innovation cluster is to provide thorough analysis of the mechanism and spatial dimensions (especially at national and regional level) which became the basis of the clustering.

Through a decade of academic research and policy analysis, the National Innovation Systems (NIS) approach has been developed to provide such framework and quantitative information. The OECD Committee for Scientific and Technological Policy (CSTP) has contributed to innovation cluster development through the NIS project, conducted in three phases (OECD, 2001).

The first phase is Managing National Innovation Systems (OECD, 1999) the second phase is Boosting Innovation: The Cluster Approach (OECD, 1999) and the last phase is Innovation cluster: drivers of national innovation system (OECD, 2001). This work provided new evidence on the systemic nature of innovation, articulated a new rationale for technology policy and identified broad directions for the improvement of national policies.

2.4. Development of Innovation Cluster in Other Countries/Regions

Since the definition of innovation cluster still in its infancy, another way to explore the definition of cluster innovation is in terms of implementation. Innovation cluster developments prove that each country or region has its own uniqueness to the composition, concept and framework of their innovation cluster.

The first is the Silicon Valley, USA. This innovation cluster is the most advanced domestic example of an innovation ecosystem. It has strong social networks, close ties with local sources of financing, well-established links among universities, federal labs and firms, and a capacity for product and technology convergence and reinvention, it started with semiconductors until nanotechnology and ICT. The determinant actors in the emergence of this cluster are Stanford University, Hewlett-Packard, University of California–Berkeley, Xerox PARC, IBM San Jose, and University of California–San Francisco.

Second is England, The Cambridge Science Park or Cambridge cluster. In this cluster, the university tried to assist innovation by dispose the problem face by the British industry and developed the Cambridge Science Park which provides space for research and office for British Startup Companies (Morgan, 2009). This idea leads to the growth of enterprise and attracts the other stakeholder to join and makes an innovation cluster.

Third is India, India has the National Innovation Council (NInC), it is formed to create a roadmap for the 'Indian Decade of Innovations 2010-2020', as declared by the Honorable President of India (university innovation clusters, 2011). In their roadmap the innovation cluster is defined as geographic grouping of institutions/firms which will catalyse and strengthen the innovation culture in the entire ecosystem. The focus is on innovation in products, processes, services and delivery which will in-turn enable growth and development. Co-operation and collaboration is the aim of the NInC to create such thriving clusters in the country.

A study of these clusters reveals that their biggest strength is co-operation and collaboration, where all actors and stakeholders are connected in symbiotic relationships. Such as those in Cambridge, United Kingdom, and India, Saxenian (2001) concluded that entrepreneurship, links to a growing market, and a supply of skilled labor are three key ingredients to successfully starting a high-tech cluster. The human connections to the high-tech community are the major affect in Silicon Valley, but the development of the cluster is essentially led by entrepreneurs (Saxenian 2002; Saxenian and Hsu 2001).

According to the literature review above, rise a question how is the development of innovation cluster in Indonesia? Does innovation cluster model in those particular developed countries can be adopted and functioned in Indonesia? What kind of model structures that will help to overcome some of barriers from our nation transformation into more innovative forms? In the next section, we tried to explain the development of cluster in Indonesia especially innovation cluster and the readiness to adopt the innovation cluster.

3. Result/Discussion

3.1. Indonesian NIS

Increasing our competitiveness and strengthening the social cohesion is the primary goal in achieving the objectives of the nation, especially in the international competition of globalization era. Countries (or regions) that are not strengthening their innovation systems will be left behind from the other countries (or areas). The implications for countries that do not strengthen the innovation system, first, the nation will be left behind in terms of intelligence, prosperity, and protection of the interests and sovereignty. Second, the ability to take advantage of opportunities and address challenges in international relations to be low. Third, in a state of inferiority, it will have low competitiveness (Taufik, ,2010).

Indonesian innovation index status, according to the global innovation index (GII), which was published in The Global Innovation Report by the World Intellectual Property Organization (WIPO, 2012), showed Indonesia was ranked 100 of 141 countries. And in South East Asian and Oceania (SEAO) showed Indonesia at position 14 from 17 country, followed by Fiji and Cambodia and Lao DPR in the last position. Singapore and Hong Kong sit on the first and second position in SEAO countries. According to the report, Indonesian innovation power is plagued by the low capacity of national innovation.

Capacity building of national innovation will greatly affect the paradigm of national economy. The regional and global economic development is leading to the era of free trade, which requires an increase in the competitiveness of the national economy so that growth could continue to rise. "Innovation is important both as an activity in its own right and as a spur to economic development – and competitiveness" (Ivarsson, 1999).

Indonesia titled as "developing country". From the viewpoint of industry, this can be translated into a landscape in which large companies are the subsidiaries of multinational companies, so the development of technology-based innovation in small companies are very rare and tend to be isolated from the sector research and development. With significant conditions, eventually the region experienced difficulty in creating an innovative industry that is based on scientific knowledge and technology, which contains its own local intellectual property (Botagaray, 2000).

The Cluster Initiative Greenbook (Sölvell, 2003) argues that four main categories of actors – governments, companies, financial institutions and the research communities– are important and usually present in a cluster. “This four main actors called Institutions for Collaboration (IFCs), defined as formal or informal actors which promote interest in the cluster initiative among the actors involved” (Sölvell, 2003).

Simplification shift of the importance of the development or strengthening industrial clusters in the innovation system concept can be illustrated as in Figure 1. Industry cluster is a set of intertwined value relationship that is often multi-and cross-(sub) sectors and thematic areas (within the meaning beyond the administrative boundaries of government).

Among the areas of Indonesia, Tegal, Surakarta City, Kendal, and Blitar are the area that eager to strengthening the innovation systems, although still in its early stages. Three major initiatives undertaken by the four areas should obtain a special note and can be a lesson (lessons learned) for the other areas. These three things are:

1. Establishment of institutional DRD (*Dewan Riset Daerah*) (as defined in the Act No.18/2002).
2. Preparation of regional strategic policy document (as defined in the Act No.18/2002), which is also referred to as the "Regional Innovation Strategy".
3. Achieving consensus on "Innovation Policy Framework" region.

Even though, the four regions has been successful in the initiation process of Region Innovation System (RIS), but in NIS scale, occurs differences in benchmarking and measuring indicators of success, by analyzing the role of government in coordinating science and technology. It can be seen that the central and local governments do not align. Raises the important lessons, the regional initiatives should be encouraged in order to increase the competitiveness of each region. In addition, institutions such as the (*Dewan Riset Daerah*) DRD in functional areas need to be strengthened for the development of science and technology is not only an obligation of the central government, but also local government.

The main actors of the national innovation system are the government as regulator, facilitator and catalyst. The second is the businesses or industries as users of the invention. The third is major research institutions and universities as producers of product invention. According to the World Bank report in 2009, the budget allocated for research and development in Indonesia is 0.08 percent of gross domestic product (GDP). This figure is relatively small compared to Japan, for example, the research and development budget of 3.45 percent of GDP (World Bank report of R&D expenditure, 2009).

3.2. Cluster in Indonesia

In Indonesia, a lot of government interferences have made help to the development of industrial clusters such as: various subsidized credit, development of human resource, ISO quality management systems, entrepreneurship program like an incubator system, partnership program, training and Technical Unit in clusters. According to Tambunan (2005), “totally there were 64 institutions involved in industrial clusters development activities with total 594 programs in the period of 1997 to 2003”.

However, in general, development of cluster policies in Indonesia is not yet succeeded. The issue is, largely due to the failure to meet the criteria of successful clusters in which one or more of these criteria are not showed up or not handled properly. Ignoring the existing market relationships and potential existing cluster is one reason for the failure. Furthermore, because the policy-making process is too centralized and oriented on the standard instrument, existing market linkages with the existing cluster potential is often overlooked in the design of the project.

This argument is supported by Tambunan and Keddie's (1998) study of leather industries in Yogyakarta and Tambunan's (1998) study of rattan industries in Padang (West Sumatra). From both findings, the common failure of government was lack of coordination between different government agencies and sometimes different agencies provide similar schemes/programs (Tambunan, 2005). Even the great Silicon Valley, Research Triangle Park and Route 128 in US as one of the most famous examples of innovation cluster, neither one was planned or created by a policy maker (Motoyama,2008).

The role of the policy maker in industrial clusters are when the industries are too weak to create external linkages or to organize joint actions among them, which mean the government role as a active actors to initiate the initiative action. However, in a long term role, the government played only as the provider of regulators and facilities. "Policies need to have an impact on productivity and innovation, not just transfer money" (Porter, 2000).

Although the implementation of cluster particularly the industrial cluster has been adopted in Indonesia for recent years, but it is still facing a lot of problems. As well as the implementation of innovation cluster is still relatively new. But Indonesia should be able to apply the concept of clusters in proper way in order to remain competitive and not left behind by the other developing countries.

4. Conclusion

All this time, the innovation system is a system that grows through the development assistance of developed countries that have been successful. Then these experiences are summarized into a global theory called the innovation system. Keep in mind, the innovation system is a success story of some developed countries. They have mastered the dominant sectors and crucial, such as science and technology which consists of advanced materials mastery, control of manufacturing systems, control systems and production processes.

By learning from the experiences of developed countries, Indonesia has to build industries and strengthen R & D capabilities with networking synergy models. Thus, any existing science and technology research led to new technologies that can be used to increase productivity. By looking at existing conditions, Indonesia needs to sharpen the orientation of the national industrial development policy to be more focused to face competition in the future. One of them is the orientation of the national industrial development policy, the national innovation system consisting of academic, business, and government (ABG).

Indonesian National Innovation System was intended to support this noble cause, and then the various other components of the nation should also provide support in accordance with the capacity and scope of their respective responsibilities.

Building and developing strong cluster, need strong policy from government. Policy to establish a strong industry cluster is better oriented to the "establishment of the basic technology infrastructure due to lack of innovative capacity of knowledge creativity and diffusion institutions" (Lundval, 1997).

Indonesia as a developing country is less responsive in building the capacity of national innovation. Capacity building of national innovation will greatly affect the paradigm of national economy, the bigger national innovation capacity the more our competitiveness in national economy. There is also a tendencies that development innovation in Indonesia firms is not prevalent, because our typified as "developing country", which large companies are the subsidiaries of multinational companies, so the development of technology-based innovation in small companies are very rare and tend to be isolated from the sector research and development.

The failure of the cluster policies made by the policy maker is one of the biggest major concerns to the development of innovation cluster in Indonesia. Policy maker must improve the productivity of the institution also the firms, facilitating information flow and the knowledge throughout actors. Not only the government, private sector also needs to be involved, maintain and increasing market competition rather than "push the market". The role of policy maker is to be an active actor not a passive. The last is integration of all actors to actualize Institutions for Collaboration (IFCs).

Innovation, diffusion and learning process became the key factors that determine our competitiveness. Through the development of strengthening our innovation system and developing of business agglomeration or clustering is the manifestation from the innovation, diffusion and learning process.

It should be noted that each type of clusters requires a types of policies to promote innovation and competitiveness - a policy that matches the type of the cluster itself. Instead, it would be difficult to create a cluster of innovation in the city without the presence of a strong industry cluster - except, of course, in areas where science and technology involved has revolutionary possibilities so that they are able to create a very new industry and market scale global. The main limitation of this paper is that it is based only on the results of a literature study. However, it has built a foundation for future empirical work.

5. Direction for Future Research

Since the mid 90's, an increasing research effort has been focused on the development of innovation clusters. And the term of innovation cluster, is one of the emergence issues in the development of National Innovation System. However, there are still many gaps for the development of innovation cluster in developing countries, especially in Indonesia.

Further study is expected to answer the finding of this study, such as developing and building a model of the national innovation capacities, how to implement the right policy in the right condition of cluster, building a model for innovation cluster implementation, role of the policy maker, how to connecting the region innovation system with the national innovation system, model of Academic, Business and Government in the implementation of National Innovation System and the innovation cluster in developing countries from theory into practice.

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