

# Development of an Innovation Cluster in the Region: Experience of Gwanggyo Technovalley in Korea

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**Abstract** Gyeonggi Province is the core area of Korea not only in terms of population, politics, and culture but also in manufacturing and industrial technologies. All the major IT companies and automakers are headquartered in Gyeonggi Province. Recently, it has started to invest at science and technology to enhance its technological competitiveness. The Gwanggyo Technovalley (GTV) is one of the major S&T policy initiatives in Gyeonggi Province, which is owned and run by the regional government. In this chapter, the theory of innovation cluster was briefly reviewed and GTV situation in 2010 is evaluated in the context of innovation cluster. It is evaluated that GTV has excellent locational advantages but there are many weak points and policy issues for the future development. For instance, it is necessary to make detailed comprehensive master plan including marketing and globalization plans. In addition, it is required to identify the technology areas for the specialization. Finally, it is concluded that GTV case shows typical (or some specific to Gyeonggi Province) characteristics of the development of an innovation cluster in the region. From the GTV case, it can be learned that more thoughts and plans are necessary on management plan as well as hardware infrastructure development in the development of innovation clusters in regional level.

## 1 Introduction

It is acknowledged that the “innovation cluster” is one of the effective policy tools to boost technological innovation in the region. For this reason, many countries are trying to establish and use innovation cluster (science and technology park).

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Gyeonggi Province of Korea is no exception. It has been developing various innovation clusters by locating science and technology organizations at close distance. Among them, Gwanggyo Technovalley (GTV) and Pango Technovalley (PTV) are the two leading technological complexes of Gyeonggi Province. In particular, GTV has emerged as a kind of innovation cluster, where research institutes, universities, and industries are at close distance and interact together for better innovation, when Advanced Institutes of Convergence Technology (AICT) was opened in March 2008.

However, there seem to be many operational issues such as networking among innovation actors, marketing of GTV, and so on. Currently, GTV does not have a dedicated managerial body and therefore has some difficulties to coordinate activities among the tenant companies and research institutes. Since GTV is established recently, it may be too early to evaluate its performance. However, it is worthwhile to evaluate in the context of innovation cluster and draw some policy lessons. As it is the regional government-driven innovation cluster of Korea, it will give some insight to look at the typical issues of innovation cluster development in the regional innovation system.

In order to evaluate the GTV in the context of innovation cluster, the S&T policy of Gyeonggi Province was reviewed. In addition, a survey was conducted to find out the direction of GTV for the tenant companies and research institutes in GTV. Finally the conclusion was drawn to suggest the direction of the regional innovation policy in Gyeonggi province.

## 2 Concepts of Innovation Cluster

First of all, it has to be mentioned that innovation cluster is different from other similar concepts such as technopark, science park, technopolis, technovalley and so on. Since there are many similar concepts for innovation cluster, it is necessary to compare and clarify the related concepts. Generally speaking, the science park was established to commercialize the R&D output of the university. That is why it is often located at or nearby the university campus. After the science park, similar complex came out in various names. It seems that science town refers to bigger complex than science park. Later technology park came out and it focuses more on industrial technology or applied science than science park. Then the name of valley started to be widely used after imitating the Silicon Valley. Now, people widely call those science and technology focused complexes, regardless of the size and specialization focus, as the Science and Technology Park (STP).

OECD (1999) argued that the cluster approach can be very effective in promoting industrial development. It uses the terminology innovative cluster, which can cover from production to science-oriented cluster. Yim (2000) instead started to use the innovation cluster, which mainly covers the science and technology park. The innovation cluster can be defined as a networked group of innovation actors and location(s), where the actors are creating economic and technological

values by interacting, competing, and collaborating with other actors in innovation processes, which functions as the source of innovative activities for the region/nation, and has global competitiveness (Yim 2002, 2008).

In addition to OECD (1999) argument, we can say cluster approach is useful because of following reasons. First, the innovation cluster rather than whole nation is the unit of competition in the real world. The national innovation system has somewhat complex characteristics and it is often difficult to make policy to promote national innovation system itself. Second, due to the close distance among the innovation actors, the innovation cluster has various advantages in S&T knowledge production, transfer, and utilization.

Since innovation process includes not only science and technology but also the actual use in the business, the innovation cluster can be thought of the concept beyond science and technology park. Like other complex or cluster, innovation cluster has similar characteristics of system. Innovation cluster, as a sort of system, is composed of many elements; actors, processes, and cultures. The actors are normally located very closely and have organic relationship, which means they share the technological innovation process to some extent. The objects of sharing can be input, process, or output according to their needs. Often the actors share similar culture and can communicate well among. The interaction normally is about money, information, scientific or technological knowledge, business opportunities, and human resources which is shown in Fig. 1.

An innovation cluster is not only naturally formed by some factors such as regional demand and abundant resource but also artificially created by government policy. Silicon Valley is a typical example of naturally formed innovation cluster whereas Zhonghancun in Chian, Hsinchu Science Park in Taiwan, Kista region in

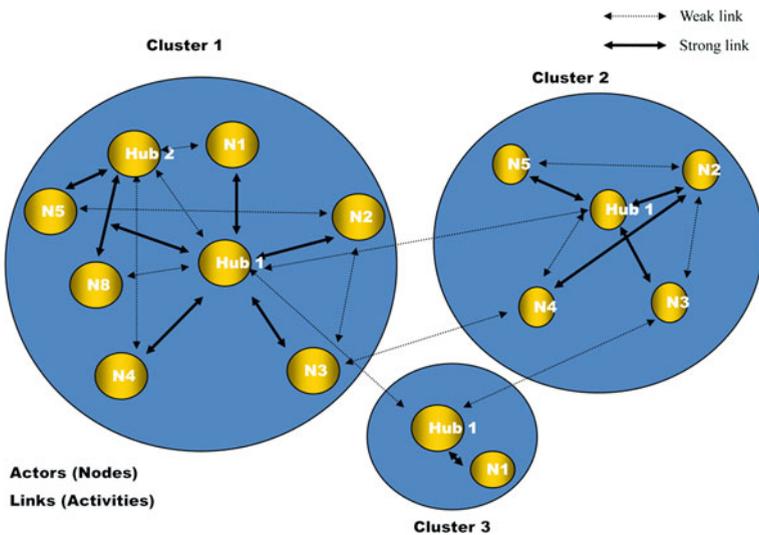


Fig. 1 Elements of innovation cluster. Source Yim (2008)

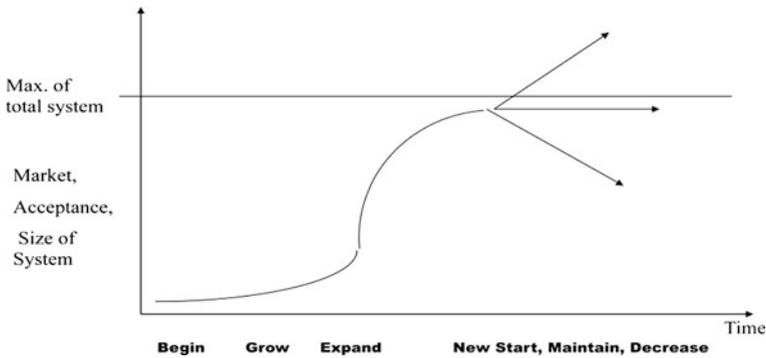


Fig. 2 Life cycle of innovation cluster. *Source* Yim (2008)

Sweden are the ones created by government. And it is obvious that such innovation clusters are leading their national competitiveness.

The innovation cluster has a life cycle, which means it is borne but also can die away as the environment changes. The developing stage of a cluster can be classified as Pre-cluster, Emerging-cluster, Expanding-cluster, and Restructuring-cluster. First, Pre-cluster stage stands for a period that few firms have very limited links among them. There is little economic impact and Anchor companies emerge. Second, in Emerging-cluster stage, firms create links and organize among themselves to form industry associations and alliances. Third, in Expanding-cluster period, linkages and critical mass grow and the economic impact is expanded. Fourth, under Restructuring-cluster stage, there are high inter-firm links. Moreover cluster spawns new clusters and begins to adapt in changing market (Sadik 2001).

The life cycle of an innovation cluster can be drawn using time, market variables. Typical pattern of growth is that it takes a shape of exponential growth. Normally, it takes a long period of time to reach a certain tipping point for the exponential growth. However, when it reach the saturation point where the innovation cluster meet the maximum capacity of total system, it either grow again, or remain at the same level, or die away Fig. 2.

For the development paths of an innovation cluster, Yim (2002) has conceptualized two different paths, in the context of value chain process. The growth of innovation cluster can be classified into two subcategories of clustering. One is “downstream clustering” where, the high science and technology level leads and expands to production and market. The other “upstream clustering,” where the strong basis of the marketing capability or production capability leads to the R&D function at the end. One example of the first type is “Silicon Valley” and that of the second type is “Dongdaemun market (Korea)” driven to subcontract production in the beginning, then with the emergence of shopping centers, synergy effects were generated from interactions between market and productive function which finally leads to the development of design (R&D) function Fig. 3.

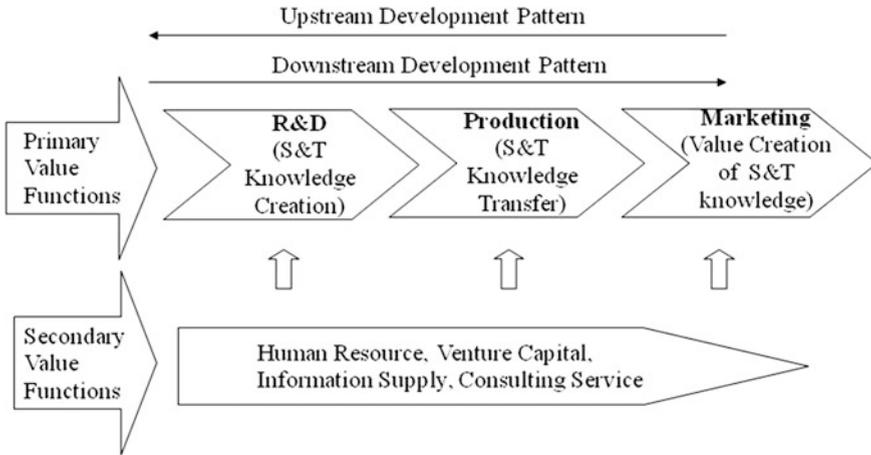


Fig. 3 Evolution or development pattern of an innovation cluster. Source Yim (2002)

The life cycle and development pattern imply that innovation cluster can be successful only when certain initial conditions are met. Therefore, it is necessary to identify such factors. Generally speaking, there are many success factors for innovation cluster development. First of all, the location is important. It represents the natural conditions like land, water, weather, and transportation. Then there comes factors like excellent technological capability, high quality people, access to market, innovative culture, venture capital, and so on. In the case of government initiated cluster, the government plays important role in the development of a cluster. So, good government policy and support are often the most important factors in the initial development period Fig. 4.

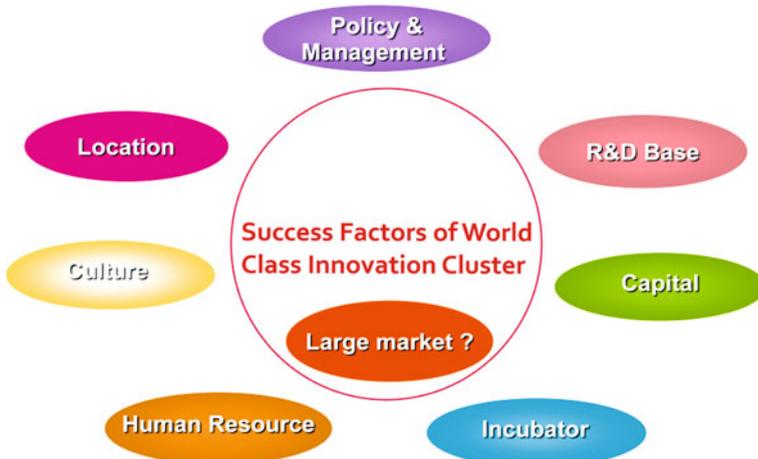


Fig. 4 Success factors of innovation cluster. Source Yim (2002)

### 3 Evaluation of Gwanggyo Technovalley

Gwanggyo Technovalley (GTV) is located at Suwon City, the capital of Gyeonggi Province, which is the surrounding area of Seoul, Korea. In Gyeonggi, there are much resources available in terms of researchers, research centers, and industries. However, it is relatively neglected in terms of central government's support because of its policy, emphasizing the balanced development of nation between metropolitan area, and other regions. Recognizing lack of central government, Gyeonggi province tries to have its own regional innovation cluster. GTV has been started as the part of new Gwanggyo Region and it is expected to play a sort of innovation hub in the region Table 1.

Gwanggyo Technovalley has become a kind of innovation cluster in the structure when Advanced Institute of Convergence Technology (AICT) was opened in March 2008. Currently there are research institutes, companies, and universities at GTV campus. Korea Advanced Nano Fab Center (KANC) was established in 2008 to promote the development of the Nano-technology (NT) and related businesses in Korea. Gyeonggi Bio Center (GGBC) was established in 2007 to strengthen global competitive power and support the bio-industries industries in Gyeonggi Province. Gyeonggi Small & Medium Business Center (GSBC) was established in 2002 to provide customized supporting service to its small and medium-sized enterprises. Gyeonggi R&DB Center (GR&DBC) was established in 2007 to build knowledge network among innovation actors by attracting internal and external excellent research institutes and companies. Finally, The AICT was established jointly with the Seoul National University. It has 2 graduate programs and 9 research centers. AICT pursues collaborative and convergent researches in the application of the latest technologies in IT, BT, and NT with the objective of commercialization Table 2.

Gwanggyo Technovalley as close to Seoul, enjoys good location advantage and it can have some synergy with other innovation clusters in Gyeonggi Province. In addition, the support of regional government is quite strong. As AICT has been established, the hardware structure is almost completed.

It is too early to say which development stage the GTV is at. Judging from the interviews with the people in GTV, it seems to be approaching into an intermediate stage between 'Pre-Cluster' and 'Emerging-Cluster' in terms of development stage

**Table 1** Status of GTV

Location	Iui-dong, Yeongtong-gu, Suwon city, Gyeonggi province
Size	269,404 square meters
Construction Period	45 months (June 2004–February 2008)
Investment	\$ 476,250,000
Tenant companies	About 230
Major fields	IT, BT, NT, CT/Original technology, and technology commercialization fostering science experts

**Table 2** Overview of 5 main institutes of GTV

	KANC	GGBC	GR&DBC	GSBC	AICT
Construction period	2003–2006	2004–2007	2005–2007	1997–2002.	2004–2008
Total building cost (\$ mill.)	\$198 mill. \$54.7 mill.	\$95.8 mill. \$4.7 mill.	\$47.8 mill.	\$85.9 mill. \$5 mill.	\$144 mill.
Central gov't expenditure					
Local gov't expenditure etc.	\$98.1 mill. \$49.9 mill.	\$91.1 mill. –	\$47.8 mill. –	\$80.9 mill. –	\$144 mill. –
Size of facilities (m <sup>2</sup> )	50,148 (16th)	32,023 (15th)	32,157 (7th)	48,653 (16th)	58,551 (16th)
Main field	NT	BT	IT, BT, NT etc.		IT, BT, NT, ET, CT
Function	To provide fab service	To support joint equipment service	To provide research and business space	To support SMEs of Gyeonggi province	Education and training
Number of employees in each center	52	16	93	29	190
Resident companies	46	26	61	50	27
(total: 210)					
Number of employees	660	386	800	757	–
(total: 2,603+)					
Number of employees (Total: 2,764+)	712	402	800	850	–

Source Yim et al. (2008)

**Table 3** Problems of GTV and policy response

Contents	Problem	Policy response
Master plan	H/W-oriented master plan	Comprehensive master plan including S/W sides
Marketing	Weak marketing & advertisement	Strengthening Global/Domestic marketing
Managing body	Management by government officials	Introduction of semi-public management body
Cluster management	H/W-oriented management for building and facilities	S/W-oriented management (network & promotion) <sup>a</sup>
Specialization	Wide and ambiguous specialization	Specialization after the review of internal capabilities
Critical mass	Small to reach critical mass	Need to attract more companies

<sup>a</sup> Gyeonggi province officially designated the management function of Pangyo Technovalley (another innovation cluster) to the newly established Gyeonggi institute of science and technology promotion in 2012

Yim and Kim (2008), Yim (2009a), and Yim (2009b)

of an innovation cluster. Although it is being developing well, there are still some issues for the development of GTV.

First of all, the innovation cluster policy is oriented too much to the hardware building like construction of building and road. The main policy of Gyeonggi provincial government on science and technology has focused much more on the infrastructure. More than half of the science and technology budget has been spent on building up the infrastructure in Pangyo Technovalley and GTV. Although building up an infrastructure is an indispensable factor in the initial development of innovation cluster, there is no concrete policy direction or s/w plan to boot research and development activities or commercializing the technology, which are required for the successful innovation cluster. There is no master plan which stated the vision of GTV and action plan after the construction Table 3.

In order to solve those problems, we may need the following policy directions.

## 4 Conclusion and Discussion

In today's knowledge-based economy, national competitiveness largely depends on the competitiveness in science and technology. Among many factors which determine the effectiveness of national or regional innovation system, the innovation cluster is regarded as one of effective policy tools to enhance the competitiveness of science and technology in the region. There are many successful cases where the innovation clusters are leading the national or regional competitiveness in the world. However, it is also true that there are many cases, where the innovation cluster does not produce the expected result.

The GTV, as the regional government initiated innovation cluster, was completed in terms of first stage of construction and infrastructure development and shows a positive sign of growth with its location advantages. However, as it has been evaluated there are many issues and problems to be solved. First of all, the hardware-oriented policy is not enough for the innovation cluster. It needs software side policy to create technological innovation and form the network among industry, university, and research institute.

Second, the role of policy research should be emphasized. It seems that the policy research is done only prior to making the decision on the development of an innovation cluster. But the whole process of development normally takes more than a decade and constant monitoring of development and performance is a must thing to do. The lack of software side program might be explained by the fact that the policy researchers were not involved in making initial development plan.

Third, the management capabilities, including marketing function should be strengthened. Only after the building was completed, the managerial body comes in. But the marketing of an innovation cluster and attracting right tenant companies should start before the construction. With global marketing program, it can shorten the growing period of innovation cluster.

Fourth, it also needs some investment on hardware side. The people in GTV need some community space, living facilities, and easy transportation. These hardware needs also had to be included in the initial plan though.

We need more case studies to generalize the development issues and problems of regional government initiated innovation cluster. The experience of GTV gives some ideas on this matter. First, insufficient plan without proper consideration on software side program might be a typical issue in the other innovation cluster. That is partly because the regional government wants to have a visible result or does not fully understand the nature of innovation cluster. Government officials and politicians are interested mostly at hardware part of STPs like building, roads, and the software parts of innovation cluster are neglected.

Second, in many cases, little thoughts were given to the governance and management of the innovation cluster. In the beginning of policy setting, the policy researchers, community people, and the managerial body should participate.

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