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Chapter 5

Trajectories of Korean Industrial Policy toward the Formation of Industrial Cluster

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1. Introduction

After the 1980's, the South Korea has accomplished the remarkable economic growth. The growth rate was recorded at around six to eleven percent by real GDP, and she reached the level of the developed country for the period of 1996 from 1985. The economic growth of the South Korea was based on the development of manufacturing, and it was promoted by the export initiation policy of the South Korea government. After the 1990's, the South Korea government started converting to the productive system for the knowledge creation type in order to produce high-value-added products as an important item of home country. The South Korea economy became hollowing out of the manufacturing, and the progress of declining birthrate and a growing proportion of elderly people, by having faced the monetary crisis in 1997. In this meaning, the construction of the productive system for the knowledge creation type becomes an urgent problem in the South Korea as well as other developed countries like Japan.

As well as Japan, for the purpose of not only national growth but also regional growth, the South Korea government has done the national land planning (or transport policy) based on the balanced regional growth, and the economic planning (or industry policy) based on the export-led growth. As a result, the South Korea succeeded in the economic development based on the export-led growth. However, economic activities have concentrated at Seoul Metropolitan Area. Such a phenomenon is similar to the capital with other developing countries. There is a clear distinction between the national land planning and the economic planning at the early stage of economic development is spite of having some interactions between these.

However, mutual supplementation of the national land planning and the economic planning strengthens in the stage of the mature phase of economic development, especially standing in the aspect of economic development in the city and the region. In other words, it has becomes difficult to classify the national land planning and the economic planning in the stage of the mature phase of economic development. Additionally, economic development at a regional level have become to have a

characteristic in own region with economic development at the country level. In fact, the industrial structure of each region becomes diversified. Therefore, the transport policy and the industry policy at a regional level become the unique one that suited the realities of many regions. In parallel with this process, the shift advances from the productive system for the mass production type to the productive system for the knowledge creation type, and the investment of such a flow becomes a main current in both a country level and a regional level.

Now, the South Korea government has been working on the construction of the productive system for the knowledge creation type under a basic strategy for balanced regional growth. Originally, these are not the independent one but the depended individually. The aim of our study is to investigate the mechanism of technological networks construction as the essential factor of industrial cluster formation. To investigate these networks, we use not only census data but also survey one. Though the survey data will be finally used in this research topic, it is important to foresee how to locate the information of these dataset. In this vein, before using survey data, this report takes a general view of advancing the industry policy toward the formation of industrial cluster formation in the South Korea.

In section 2, we review theoretical background of the importance of knowledge spillover and how to handle these effects as the formation factor of industrial cluster. In section 3, we summarize the trajectories of the South Korea's industrial policy, and the distribution of industrial complexes as the "base" of industrial cluster and that of investment of education, science and technology facilities. Finally, we conclude the report with Section 4.

2. Theoretical background

Korea became a developed country as well as Japan, too and it comes to a standstill because of not good at controlling economic development in the future. Regarding the cause of Japan's "lost decade", some literature such as Harada (1998) and Ikeo (2001) advocate that Japanese social and economic system have been kept in 1970s structure and this structure have brought out today's stoppage in the business. Similarly, Seki (1997) argues that industrial structure in each local economy constructed until early 1970s has been effective in today's state of each city. In any case, both on the national and local level, Japanese economy seem to be rocked in old social and economic system. Although we don't inquire into closely these discussions, especially the truth of the

initial point, the point under discussion that prior condition influences current state is interesting. The context of this discussion is common with that of dynamic externalities that deal with the role of prior information accumulation in local area on current productivity. This phenomenon has hold true to not only Japanese economy but also Korean Economy. The essence of this study is in inquiring into the process and the effects of knowledge spillovers in the city.

However, the literature about knowledge spillovers in the city is not new. In fact, almost all of the previous studies about knowledge spillovers in the city (industrial concentrations) are attributed to Marshall's seminal work. Marshall (1890) stated that knowledge spillovers and formation of skilled labor pooling are creating "something in the air" in agglomeration economies of specific industry. In later years, Jacobs (1969) argued that the most important knowledge spillovers come from other industries rather than same industry as oneself. In Jacob's words, "In cities with many organizations supplying so many bits and pieces of work, it is possible to start a new exporting organization while depending upon others for many of the goods and services one needs (Jacobs, 1969, p. 181)."

Most studies on Marshall's specialization and Jacob's diversification examine the effects of these externalities on urban growth with inconclusive discussion as to weather specialization or diversification is conducive. As pioneer studies about dynamic externalities, Marshallian and Jacobian externalities, Glaeser, Kallal, Scheinkman and Shleifer (1992) found supportive evidence of Jacobian externalities, whereas Henderson, Kuncoro and Turner (1995) found that Marshallian externalities work on mature industries while both Marshallian and Jacobian externalities behave well on new high-tech industries. In addition, recent studies linking the original studies of dynamic externalities to the others about geographical proximity and usages of patent citation as an innovative output that start from Jaffe, Trajtenberg and Henderson (1993) are advanced. Some of these new studies such as Shefer and Frenkel (1998) and Paci and Usai (1999) revealed that both Marshallian and Jacobian externalities have positive effects on regional innovative activity, especially in high-tech industries. The others of these new studies such as Feldman and Audretsch (1999) revealed that only Jacobian externalities enhance the birth of innovation in high-tech sectors at specific locations. And, Kelly and Hageman (1999) showed almost same result about both mature and high-tech sectors.

In either case, it is widely accepted by economists because firms benefit from

knowledge spillovers that give rise to aggregate increasing returns to scale due to non-excludability and non-rivalry of knowledge. Concerning this issue, Romer (1986) was one of the first contributions to formalize knowledge spillovers as a source of endogenous growth. Provided that the benefit of knowledge spillovers is sensitive to geographical proximity, especially because the knowledge is tacit in nature, it can be regarded as a source of agglomeration economies. In this reason, whether in urban center and/or local city if technological knowledge is accumulated, the region can also be understood as spaces of collective technological learning.

The new economic geography (Fujita, Krugman and Venables, 1999) provided one answer for the reason of why and where agglomeration economies form. However, these studies have deliberately avoided inquiring into closely the roles of innovation and/or knowledge spillovers in agglomeration economies. This is almost all attributed to Krugman's statement: knowledge spillovers "are invisible; they leave no paper trail by which they may be measured and tracked, and there is nothing to prevent the theorist from assuming anything about them that she likes (Krugman, 1991, p.53)." Whereas, it is recognized as a challenge for anybody seeking any relevant spatial economic model of knowledge spillover to be able to address: "not only that knowledge spills over but also why those spillovers decay as they move across geographic space (Audretsch and Feldman, 2004)." After a while, as Fujita and Thisse (2001) correctly observed, existing knowledge spillover model has the weakness of leaving vague the sources of external economies, and the underlying mechanism of the local interaction is not clearly defined. Those previous studies have not considered explicitly what kind of interaction of firms and people can generate the externalities of communication and technological exchange. They usually assume that the increase in the number of locally participating agents may increase interaction, keeping the actual interaction in the black box.

Although there are excellent descriptive works such as Saxenian (1994), considerable work of theoretical nature remains to be done incorporating geographical proximity and innovation. One promising direction was shown by Aydogan and Lyon (2004). Their paper argues that technological complementarities will increase the benefit of cooperation in R&D. Exchange of ideas can be done conveniently at a central place meeting such as academic congress but the fear of being cheated, by someone who just attend the meeting without contributing with his own idea, makes bilateral traveling preferable. In such a case, agglomeration of technologically complementary firms will be beneficial in order to save on traveling cost.

The empirical studies in this vein should face the difficulty of lack of data and ambiguous concepts of measurement of "innovation", "knowledge", and "proximity". As done by Jaffe, Trajtenberg and Henderson (1993), it is common to consider that output of innovation is represented by patent, which is also convenient because patent data is relatively easily accessible. Yet patent may not be perfectly good proxy of innovation, because all innovative output are not necessarily patented, and all patent will not lead to innovation. Alternatively, Charlot and Duranton (2004) prefer to measure the effect of communication externalities by earned wage, while Anselin, Varga, and Acs (2000) use the U.S. small Business Administration Innovation Database (BAID), which measures innovation by the number of new product announcements in trade and technical journals. In turn, knowledge is treated as a sort of firm capital stock to produce innovation. Its measurement is also a subject of debate in constructing a meaningful index synthesizing R&D investment, employment of knowledgeable talent and evaluation of stock reflecting a depreciation of the past accumulation. Regarding the proximity, we should take into account the concept of distance, traveling time (including the means of transportation), and the use of telecommunication (because face-to-face communication and telecommunication is sometimes complementary with each other, rather than substitute).

Since almost all of the previous studies use census data to investigate the evidence of external economies without taking actual relationships among firms and/or industries, we can hardly expect that any usable data-set is readily available. In general, when we measure the effects of externalities or knowledge spillovers from industrial agglomeration we assume implicitly existence of externalities or spillovers even if an actual interaction exists or it doesn't exist. For this reason, it is unavoidable to conduct questionnaire survey to investigate the firms' actual relationships among business partners of industry-academia-government through real communication mode: how often, with whom where do, in what means, and for what purposes. In fact, recent studies such as Adams (2002), Charlot and Duanton (2004, 2005), Arita, Fujita and Kameyama (2006), Hamaguchi and Kameyama (2007, 2008) and Kameyama and Hamaguchi (2007) have examined the effects of communication externalities using survey data after specifying the existence of actual interaction.

In the following, it takes a general view of the trend of the industrial cluster policy of the South Korea before the analysis of an actual questionnaire survey.

3. How to form Industrial Cluster in Korea

3.1 Trajectories of Korean Industrial Policy and KICOX

As mentioned in introduction of the paper, the economic growth of the South Korea was based on the development of manufacturing, and it was promoted by the export initiation policy of the South Korea government. In the following, we explain the way of an industrial promotion in South Korea from the aspect of a regional industrial policy. The South Korea government has advanced the creation of a national industrial complex for the purpose of achieving of balanced regional growth. The creation and the management of national industrial complexes have been executed by present Korea Industrial Complex Corporation (KICOX). The origin of KICOX is in “Korea (Regional) Management Corporation” that separated into five regions and has managed an industrial complex individually. Table 1 reports the easy explanation of history of KICOX and Korean regional policy. In 1964, Korea Export Industrial Corporation was established. Following this, Korea Management Corporation, for Central Complexes was in 1971; Korea Management Corporation, for Southeast Complexes was in 1974; Korea Management Corporation, for Western Complexes was in 1977; Korea Management Corporation, for Southwest Complexes was in 1990. The South Korea government succeeded in constructing the productive system for the mass production type, and has promoted economic development based on the export-led growth with these national industrial complexes.

Table 1: The history of KICOX and Korean regional policy

Operation policy: Five regional management corporations established (1964-1996)	
Year, Month	Events
1964, Aug.	Korea Export Industrial Corporation
1971, May.	Korea Management Corporation, for Central Complexes
1974, Apr.	Korea Management Corporation, for Southeast Complexes
1977, Nov.	Korea Management Corporation, for Western Complexes
1990, Nov.	Korea Management Corporation, for Southwest Complexes
Operation policy: KICOX launched (1997-Present)	
Year, Month	Events
1997, Jan.	Korea Industrial Complex Corporation established
Operation policy: Expansion of Management areas for KICOX (1998-2003)	
Year, Month	Events
1998, Aug.	Managing of Paju Complex for publishing, culture and information
1999, Aug.	Managing of four national complexes (Noksan, Daebul, Daebul foreign, Gwangyang complexs)
1999, Nov.	Managing of Paju-Tanhyeon lease complex for small and medium enterprises
2002, Feb.	Managing area of the foreign investment in Gumi and Ochang
2003, Apr.	Managing of Osang Bio-health Technopolis
Operation policy: Innovation Clusters of Industrial Complexes (2004-Present)	
Year, Month	Events
2004, Jun.	Selected as an organization in charge of promoting innovative clusters of industrial complexes
2005, Mar.	Managing area of the foreign investment in Inju
2005, Nov.	Managing of Iksan national complex
2007, Apr.	Managing of Jinsa lease complex
2007, Jun.	Managing of areas of he foreign investment in Jinsa

(Source) KICOX brochure, 2003, 2004, 2007

However, the progress of each country of Association of South-East Asian Nations (ASEAN) and China have came to urge the conversion of the industrial structure on the South Korea economy as Japanese economy had experienced by the progress of Asia NIEs (Newly Industrializing Economies) before years. In 1997, the South Korean government integrated five regional management corporations into one unified system in order to strengthen international competitiveness of their own industries that derived from the changes of industrial structure. As the results, KICOX established to manage all regions and national industrial complexes. Table 2 reveals the five regions and 33 national industrial complexes that managed by KICOX.

Table 2: Development situation of national industrial complexes in the South Korea

Region	Complex	Designated year	Scale (1,000㎡)	Number of Resident Firms		Number of Employees		Number of Employees Engageds One Firm		Remark
				2004	2007	2004	2007	2004	2007	
Gyeong-in	Korea Export	1964	3,728	3,634	7,634	69,744	112,200	19	15	
	Seoul Digital	1964	1,982	3,048	6,715	51,558	91,736	17	14	
	Bupyeong	1965	609	193	490	7,301	9,709	38	20	
	Juan	1969	1,136	393	429	10,885	10,755	28	25	
	Namdong	1986	9,574	3,961	4,205	64,284	63,514	16	15	
	Bukpyeong National	1975	1,624	5	33	235	385	47	12	For Sale
	Bukpyeong Local	1975	715	90	96	709	669	8	7	For Sale
	Paju Publishing	1997	1,507	185	271	1,270	2,834	7	10	Developing
	Paju Tanhyeon SME	1998	77	49	59	312	388	6	7	
	Sub-total	-	17,224	7,924	12,298	136,554	179,990	-	-	
	Average	1977	2,153	991	1,537	17,069	22,499	21	14	
Western	Banwol	1977	15,374	2,440	2,939	69,127	87,362	28	30	
	Sihwa	1986	16,568	4,480	5,619	54,177	85,952	12	15	
	Asan	1979	11,635	198	298	6,052	10,169	31	34	For Sale
	Inju (F)	2004	165	-	4	-	81		20	
	Cheonan (F)	1994	714	41	44	1,964	3,578	48	81	
	Seokmun	1991	10,872	-	-	-	-	-	-	Undeveloped
	Sub-total	-	55,328	7,159	8,904	131,320	187,142	-	-	
	Average	1989	9,221	1,790	1,781	32,830	37,428	30	36	
Central	Gumi	1969	21,724	750	961	76,649	74,633	102	78	For Sale
	Gumi (F)	2002	559	6	9	200	1,536	33	171	Leasing
	Ochang (F)	2002	496	4	10	99	1,199	25	120	Leasing
	Osong Bio-health Technopolis	1997	3,956	-	32	-	-	-	-	Developing
	Daedeok Techno Valley	1991	1,986	109		342		3	-	For Sale
	Sub-total	-	28,721	869		77,290		-	-	
	Average	1992	5,744	217		19,323		41	123	
Southeast	Changwon	1974	25,302	1,338	1,717	71,562	78,002	53	45	
	Ulsan Mipo	1975	46,135	590	733	87,137	85,073	148	116	
	Onsan	1974	17,246	215	268	9,855	10,244	46	38	
	Anjeng	1974	2,843	13	17	2,194	4,539	169	267	For Sale
	Myeongji Noksan	1989	6,972	1,183	1,376	22,452	23,523	19	17	For Sale
	Jinsa	2006	392	-	22	-	-			
	Jinsa (F)	2002	496	8	9	165	150	21	17	Leasing
	Sub-total	-	99,386	3,347	4,142	193,365	201,531	-	-	
	Average	1985	14,198	558	592	32,228	33,589	76	83	
Southwest	Yeosu	1974	30,633	147	206	12,354	12,322	84	60	
	Gunsan	1987	6,828	107	133	5,984	7,019	56	53	For Sale
	Gunjang	1989	13,494	5	127	66	442	13	3	Developing
	Ikusan	1977	1,116	-	211	-	3,788		18	
	Gwangju Hi-tech	1990	2,430	188	316	5,665	6,455	30	20	For Sale
	Pyeongdong (F)	1994	1,234	49	55	1,403	2,193	29	40	Leasing
	Daebul	1988	8,794	141	252	1,639	2,983	12	12	For Sale
	Daebul (F)	1998	1,614	20	39	647	1,732	32	44	Leasing
	Gwangyang	1983	1,731	66	64	4,239	4,218	64	66	
	Sub-total	-	67,874	723	1,403	31,997	41,152	-	-	
	Average	1987	7,542	90	156	4,000	4,572	40	35	
33 Complexes	Total	-	268,533	20,022	27,759	570,526	687,183	28	25	
	Average	1986	7,672	667	841	19,018	22,167	41	48	

(Note) The mark of (F) reveals the complex that foreign invested firms locates.
(Source) KICOX brochure, 2003, 2004, 2007

3.2 Trajectories of Innovation Policy

In order to shift their industrial structure from mass production type to knowledge creation type in an international economic upgrade, KICOX have set up a foreign firm specialized complex such as *Daebul*, *Cheonan*, *Gumi*, *Pyeongdong*, *Ochang*, and *Jinsa*,

and have worked on the investment of the foreign firm attract since 1999. However, a social economic system of the South Korea fell into chaos by the monetary crisis in 1997. This accident forced the South Korean government to do fundamental structural reforms. Drastic structural reforms of the South Korea economy can be understood as a shift to a social economic system of the knowledge creation type mainly based on the small and medium-sized firms (or venture companies), from a social economic system of the mass production type mainly based on the big enterprise such as *Chaebol*. Therefore, it is necessary to support the small and medium-sized firms, venture companies, and the entrepreneurs in the industrial policy, and to activate the innovation activity. The South Korea government enacts "National balance development special law" in 2004, and is working on the promotion business of "Innovation Cluster" under five years plan of basically law. The formation of "Regional Innovation System (RIS)" has been promoted in the South Korea for the construction of the productive system for the knowledge creation type before this. RIS is the one of dropping "National Innovation System (NIS[1])", and it is not a national unit policy but regional one in order to improve the effectiveness. Because the source of the innovation is derived from knowledge spillover, it is useful for inquiring into the mechanism of the knowledge spillover than the unit of the space that can execute communications of region in daily life is much suitable than the unit of the space of nation. Therefore, KICOX specified the following eight by both a national level and a regional level for an exemplary industrial complex where the innovation activity was pulled. *Daedeok* was specified for research and development district. *Banwol-Sihwa*, *Gumi*, *Ulsan*, and *Changwon* were specified for an industrial complex where present key industry had been made a nucleus. *Wonju*, *Gunsan*, and *Gwangju* were specified for an industrial complex where next generation's industry had been made a nucleus. Thus, the South Korea government is executing the cluster policy for the construction of the productive system for the knowledge creation type. Regarding an innovation and the formation of industrial cluster, because mass arranges both social infrastructures and the intellectual foundations, the metropolitan area is thought to be advantageous for the formation of an industrial cluster.

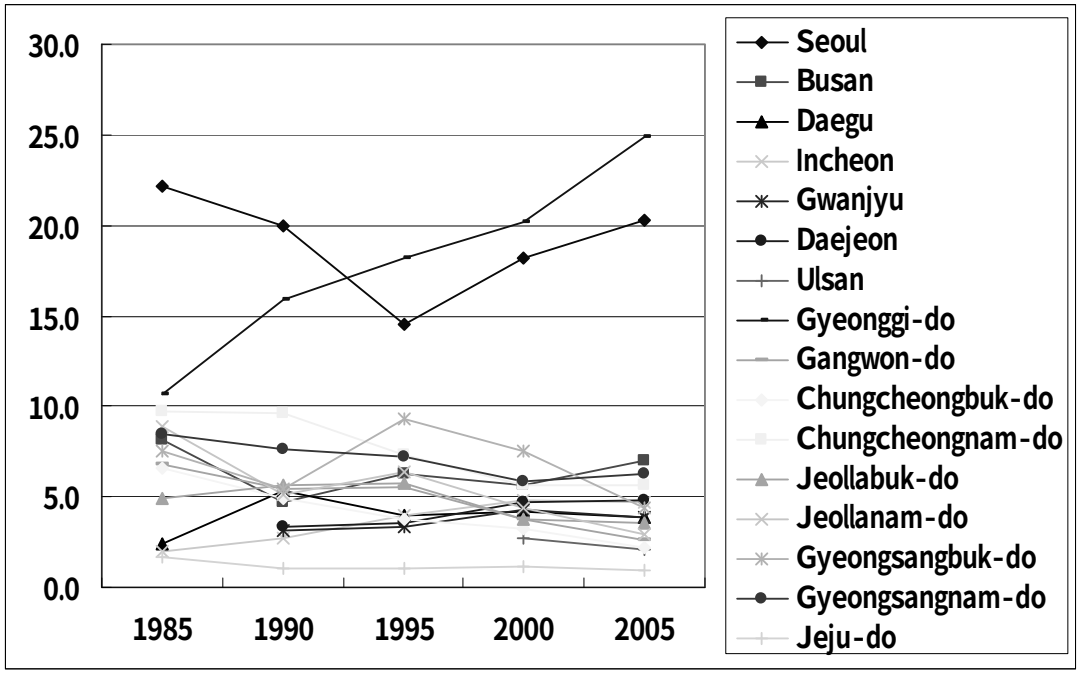
[1] NIS has been adopted in the policy in Europe region (Cooke, Heidenreich and Braczyk, eds., 2004).

3.3 Advantage of Large Industrial Complex to form Cluster

In Table 2, an industrial complex where a lot of numbers of employees exist is *Seoul Digital Industrial Complex (SDIC)*, and *Banwol-Sihwa*, *Ulsan*, *Changwon* and *Gumi* are following. An industrial complex where a lot of numbers of firms exist is *SDIC*, and *Banwol-Sihwa*, *Namdong* and *Changwon* are following. About these comparative large industrial complexes, if the number of employees engaged one firm is seen, the value of *SDIC*, *Banwol-Sihwa* and *Namdon* has become small. This reveals that the share of the small and medium-sized firm is high as for these industrial complexes. Oppositely, the greater part of an exemplary industrial complex is thought that the share of the small and medium-sized firm is low because the number of employees engaged one firm is large. These characters indicate that Seoul Metropolitan Area as the large city have an advantage to form the industrial cluster based on the small and medium-sized firm as a nucleus.

In addition, this can be confirmed by seeing the trend of the amount of the annual expenditure related to the education, science and technology facilities by regional level. Figure 1 reveals a summary of the ratio of the cost of construction related to the education, science and technology facilities of each region occupied to the total construction cost of the South Korea.

Figure 1: Transition of r the ratio of the cost of construction related to the education, science and technology facilities of each region occupied to the total construction cost of the South Korea (1985-2005)

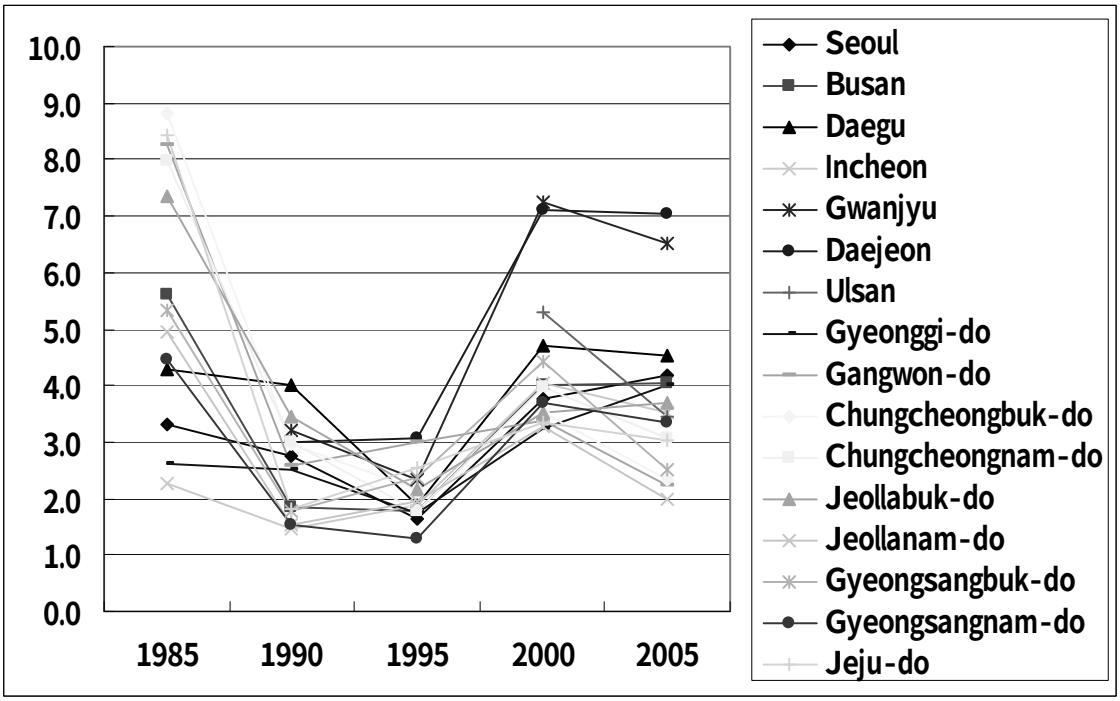


(Source) Korea National Statistical Office (various years)

The ratio of Seoul and Gyeonggi-do overwhelms other regions, and the total of those shares changes in about ranges from 33 to 41 percent. The investment's having concentrated on the metropolitan area region (Seoul and Gyeonggi-do) in the South Korea suggests the excessive concentration of an economic activity to the metropolitan area region.

On the other hand, Figure 2 reveals a summary of the ratio of the cost of construction related to the education, science and technology facilities that occupy it to the total construction cost of individual regions in the South Korea.

Figure 2: Transition of r the ratio of the cost of construction related to the education, science and technology facilities that occupy it to the total construction cost of individual regions in the South Korea (1985-2005)



(Source) Korea National Statistical Office (various years)

In 1985, the regions on where the ratio of expense concerned is high were Chungcheongbuk-do, Jeju-do and Gangwon-do, to the contrary, the regions from the under where the ratio of expense concerned is low were Incheon, Gyeouggi-do and Seoul. The tendency of investment is different in a region where economic development is advanced and late. It reveals that the regional differential was corrected by the investment in the region where economic development was late. Toward the 1995, the ratios of all regions have been declining. After 1995, the ratios of all regions have turned to increase. Especially, an increase in the investment of Daejeon, Daegu and Gwanjyu is remarkable. It is thought that these regions are the causes of an increase of the investment because it holds an exemplary industrial complex as the leading center of innovation activity.

4. Concluding remark

The formation of an industrial cluster on order to create innovations advanced by the government initiation as a base as having seen in above part in the South Korea. However, the number of the specification of industry complex is more than that of

Japanese cluster project. The South Korea did concentrated investment in the transport policy, and has kept airport and harbor competitiveness internationally. In that sense, the cluster policy has the possibility that the investment or agglomeration has been distributed too much. For example, China government have specified specific region like Beijing (Zhongguancun) and Suzhou as a high-tech science park, the investment efficiency has been raised in these regions.

According to the our interview and site investigation, though Suzhou is regarded the second Science Park in China, however, the realities of Suzhou Science Park are far to an industrial cluster that creates of the innovation by the industry-university-government cooperation. Appearance of reality of Suzhou Science Park is industrial agglomeration based on the only enterprise accumulation. It is interesting how to involve the university in Suzhou in the future. In this vain, it is supposed that the South Korean case or Japanese Case have useful information to promote the industry-university-government cooperation in China.

Hamaguchi and Kameyama (2007, 2008) reveals that the market of large city and the knowledge base such as universities are formation factors of technological network that stuck to the region is made in Beijing and Seoul. In this research topics, we will focus on Korean case to investigate this point in detail.

These conclusions give us some directions for future task. It is desirable to know about what really happens when firms communicate in the district of industrial cluster, especially the spatial range of technological networks and the location of their partners. For the purpose of inquiring these topics, we will use survey data conducted in the some industrial complexes of the South Korea. Starting the analysis with descriptive, we will attempt to explore causality issues. The relationship between the communication externality and intensity of innovation is especially important.

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