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Recreating Competitive Global Innovation Clusters in Korea : Switching Forces and Collective Responses*

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Abstract : This paper searches for a potential path of Korean clusters to be competitive global innovation clusters (CGICs) and provides appropriate policy interventions to promote the cluster formation process in Korea. It argues that clusters which have their distinctive competitiveness are created as the cluster members are collectively responding to the switching forces in a rapidly changing capitalist economy. The Korean economy has acquired various assets through the rapid economic progress and these can be efficiently utilized for the creation of globally leading clusters in Korea. The process is not just copying the one and only Silicon Valley model but to create the distinguished Korean model of locally embedded innovation. That requires a recreation process of innovationclusters in Korea.
Keywords : global innovation clusters, Korean model, switching forces, collective responses

요약 : 본 고에서 우리나라의 클러스터들이 세계에서 경쟁력 있는 혁신클러스터로 자리매김할 수 있는 잠재경로와 클러스터의 형성을 촉진할 수 있는 정책개입의 방향에 대하여 탐색하고자 한다. 세계적인 클러스터가 되기 위해서는 클러스터의 구성원들이 끊임없이 변하는 자본주의 경제의 전환력에 대하여 집단적으로 대응하는 것이 필요하고 그 과정에서 각기 독특한 경쟁력이 창출된다는 것이 이 논문의 핵심적 주장이다. 우리나라는 급속한 경제성장 과정에서 다양한 자산들을 축적하였고 이런 자산들은 우리나라에서 세계적인 선도 클러스터를 창출하는 데 효과적으로 활용될 수 있다. 이 과정은 실리콘밸리와 같은 유일한 모델을 베끼는 것이 아니라 한국의 지역적 조건에 맞는 독자적인 모델을 창출하는 것이다. 이를 위해서 우리나라 혁신클러스터의 재창조 과정이 요구된다.
주제어 : 세계적 혁신클러스터, 한국형 모델, 전환력, 집단적 대응

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1. Introduction

As we adopt the cluster phenomena as an evolutionary process of birth, growth, and demise in an uncertain environment, 'open windows of locational opportunities' (Scott, 1988, Storper and Walker, 1989) can succinctly describe the locational dynamics of high technology sectors and the formation of new clusters (Boschma and Frenken, 2006). As a locality is well equipped in a continuously changing global economy, it can enjoy taking the opportunities to capture the technological dynamics leading to the local prosperity.

The Korean system has been quite successful and was praised as a next Asian giant (Amsden, 1989). The system competitiveness was achieved through so called 'developmental state model' which was fueled by the efficient and committed central government and their strategic partners of large conglomerates. The legacies of the model, however, is said to be bottlenecks for the creation of innovation clusters in Korea, which is crystallized as a continuous experimentation of creativity in a locally embedded environment (Saxenian, 2006).

In this paper, I would like to argue that there are certain necessary conditions to lead to the creation of competitive global innovation clusters (CGICs) in Korea, which have been nurtured in the domestic production systems of Korea during the rapid economic growth. For the transformation of the large company dominating local production systems to be CGICs, the sufficient conditions of collective responses of local actors are required. This paper pursues to suggest major policy agendas to create CGICs in Korea based on the diagnosis of these necessary and sufficient conditions.

For this purpose, the creation of CGICs will be conceptualized as differentiated models to trigger the collective responses of cluster members to the switching forces which are enforced to them in the changing multi-scalar interactions. Based on this concept, the Korean system with one typical case of a mobile cluster of Korea will be explained to find out the alternative solutions to respond in a changing global economy. And the achievement and limits of the previous government' s RIS policies will be critically reviewed. After that, the policy suggestions will be followed with an alternative way of creating 'large economic zones' of the current government.

2. Recreating Competitive Global Innovation Clusters (CGICs)

1) Cluster Evolution: Critical Mass Creation and Continuous Influx of External Resources

A cluster is defined as a localized industry configuration such as a local or regional concentration of industrial firms and their support infrastructure of traded and untraded interdependencies (Bathelt, 2005). The formation and evolution of the cluster is sustained by the two forces of critical mass creation in the region and continuous influx of talents and resources from external sources. And this process occurs in the multi-scalar spatial interactions.

The cumulative process of industrial clustering is driven by a new process or specialized inputs, or a pool of skilled labor, technological or knowledge spillovers from high-technology sectors (Prevezer, 1997). The creation of a critical mass of one sector of an industry developing in one place may attract other firms in that sector to that location and it creates another attractive force a core sector of an industry has on auxiliary sectors of the same industry, drawing them to its location (Prevezer, 1997).

The evolution of a cluster is also triggered by the structure that enables diversity within a given competence area but with the minimum of coherence. The process of institution-building is shaped and stimulated by existing communication practices, the quality of local buzz, and the formation of communities (Bathelt, 2005). Localized learning which is constrained by bounded rationality and routines and the processes of information exchange triggered in local buzz lead to the gathering of cluster actors in a confined area of innovation (Maskell and Malmberg, 2007).

The institutionalization process of a cluster is conditioned by the knowledge bases of clusters and characteristics of cluster initiators. Two different knowledge bases can be considered (Asheim and Gertler, 2005). For synthetic knowledge bases related with the application or novel combination of existing knowledge, tacit knowledge is important and spin-off and new firm creation is not relevant in this knowledge industry. Analytical knowledge bases are scientific knowledge based on formal models and codified science and rational processes and knowledge codification and spin-off and new firms are important for this type of knowledge industry.

The characteristics of cluster initiator influence the relational principle of cluster institutionalization process. Large companies, which have strong bargain powers against small and medium sized companies, may try to dominate the relationship among the cluster actors while they form and lead the local business networks. The collaboration among small and medium sized companies may have strong rationale for competitive collaboration among them, which is not be easily triggered because there is no champion to coordinate their networks. The government may design and trigger the local industrial promotion but it is not easily adapted to the coordination mechanism of market.

The process of critical mass and diversity creation in a region for the cumulative clustering process is not confined in a locality and is including national and global dimensions (Lee, forthcoming). The related value chain of industrial activities agglomerated in a regional cluster is always extended to the national and global division of labor (Cooke, 2004). And exogenous actors and relationships play a larger role in a regionalized national innovation system (Asheim and Gertler, 2005). Communities of practices also cross inter-regional and even international boundaries.

2) Engines of Clusters Formation; Switching Forces and Collective Responses

The above mentioned initial conditions of a region to coordinate local cluster members to work for the transformation to the innovation clusters are constituted by the diverse multi-scalar interactions (Figure 1).

Distinctive regional institutional endowment is associated with particular regimes of business systems and institutional frameworks at the national level (Asheim and Gertler, 2005). The evolutionary process of clusters is influenced by specific macro-conditions. At the macro-level, there are specific drivers and constraints of market developments and broad institutional regimes (Maskell and Malmberg, 2007). Institutions are established at the macro-level as resilient humanly devised constraints that structure interactions in society which create incentives and guidelines for action. Bathelt (2003) also argues that the level of national state is important in determining the configuration of a regional production system and a region might be illustrated as an entity that hosts a large part of a global economic value chain.

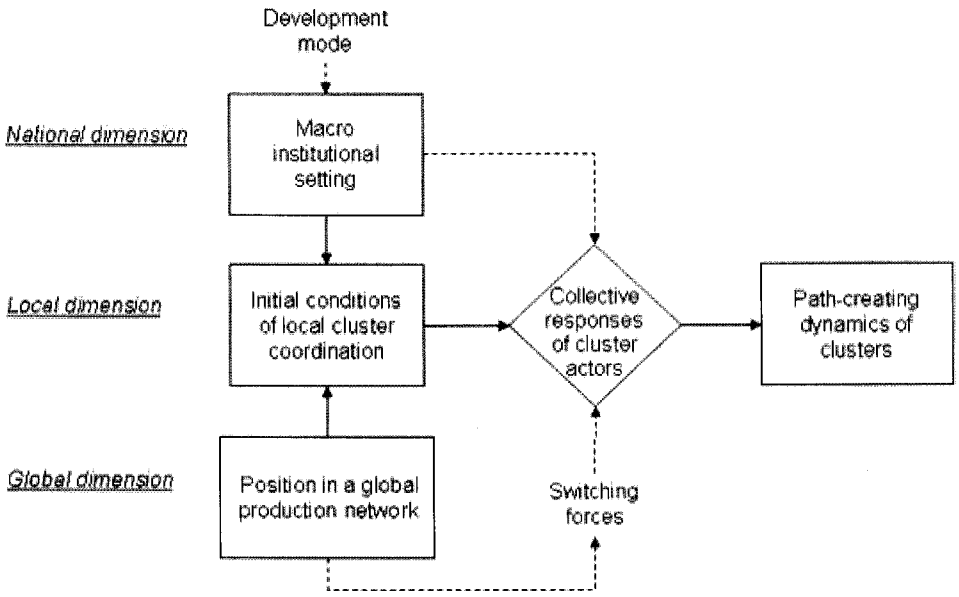

Figure 1. Cluster dynamics in a multi-scalar framework

Source: adapted from Lee and Kim (2008)

A general correspondence is found between the macro institutional characteristics of the economy and the dominant form and character of its regional innovation system (Asheim and Gertler, 2005). While coordinated market economies on the macro level support cooperative, long-term, and consensus-based relations between private as well as public actors, liberal market economies inhibit the development of these relations but instead offer the opportunity to quickly adjust formal structures to new requirements. Under divergent sets of national institutions governing capital and labor markets and corporate governance, the kinds of social relationships that are likely to develop between economic actors locally and hence the social organization of local innovation and production systems will vary dramatically.

The position of local clusters in the global market is also important for institutionalizing local coordination mechanism. The regional assets are integrated into global production networks (Henderson *et al.*, 2001). Leading companies and regions organize their production networks together. Those regions that have been successfully adopted by global companies or have entered the networks of global companies are able to sustain their competitiveness in the competing global economy. Co-existence of high levels of buzz and many pipelines provide firms located in outward-looking and lively clusters with a string of particular advantages not available to outsiders (Bathelt et. al., 2004).

The transformation to innovation clusters is, however, not an autonomous process (Figure 1). The technology dynamics of clusters were not automatically created in the diverse famous clusters without switching opportunities and forces. As a region is often exposed to a globally competitive environment, it faces switching forces to transform itself. The regions which have collective responses to the forces can be

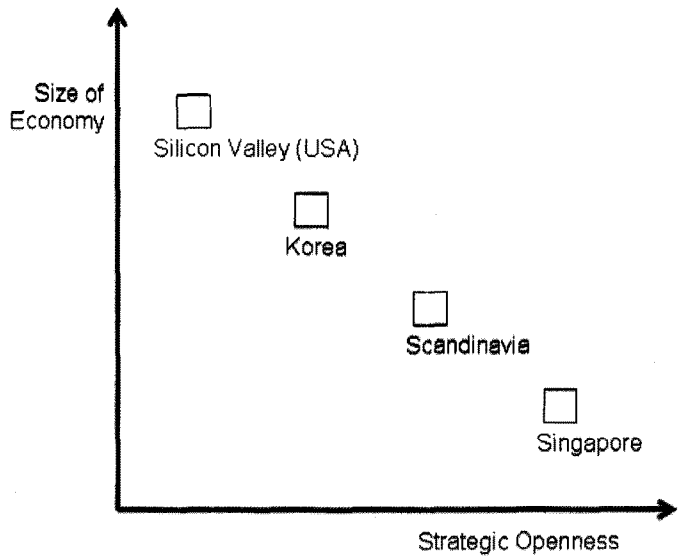

Figure 2. Different Cluster Positioning

developed into innovation clusters. And they will lose their cluster dynamics if they do not sustain their dynamic forces because of the functional, cognitive, and political lock-ins (Grahber, 1993).

Through the technology dynamics creation with these collective responses, many clusters can build up their distinguished characteristics of horizontal networking and system competitiveness. Expansion of collective bargaining power against large companies through the rapid market diversification and differentiation has fueled the community based *Flexible Manufacturing System* (Piore & Sabel, 1984). Horizontal networks between big companies & SMEs in Baden Württemberg of Germany were also triggered by the expansion of externalization in scope diseconomy with requiring continuous innovation of suppliers from severe global market competition.

3) Contextualized Strategies toward Openness

Creation of critical mass and diversity in a localized institution to trigger continuous influx of external resources is a key for the transformation to the competitive global innovation clusters. Therefore the strategic openness of a local/national system is inevitable for the creation of new technology dynamics in a region. The innovation can be understood as a globally networked process as every region competes with each other to mobilize diverse resources globally.

The ways to create these institutional settings to induce external resources are diverse according to the local/national contexts. Therefore, it is not realistic to copy the only and one model of cluster such as Silicon Valley. OECD (2001) also argues that there is no one and only cluster in the world. To find out the difference of strategic position in the open and competing global economy, the Korean situation was compared to the three different economic size country clusters (Figure 2).

Small countries such as Singapore have adopted a nation-wide open economy to induce foreign resources (Yeung, 2006). Their confined resources of small

population and location advantages in the global market have led their special pathways of nation-wide open economy based industrialization. A business friendly environment have been strategically developed for the multi-nationals and compensated to freely utilize the strategic opportunities Singapore provides to overcome their limited resources.

Scandinavian model of clusters are a little bit different from Singapore even though they also highly rely on external resources for their continuous innovation. They are situated between large economies such as Germany, France, and England. In between these large economies they strategically positioned to take niche markets and develop their own macro economic institutions to cultivate their cooperative environment. Based on this internal cooperation model, Ericsson developed its distinguished model to open its platform to induce various resources of companies and researchers around the world (Casper, 2006). Their creativity contributes to the strengthening of Ericsson and its innovation system.

Silicon Valley has shown its continuous experimentation of creativity in a localized institution (Saxenian, 1994, 2006). This model has been triggered by the continuous change of dominant industry from defense (1950s), integrated circuits (1960s and 1970s), personal computers (1980s) to internet (1990s) (Henton, 2000). So in this transient industrial environment, new ideas and business models are welcomed. And the dominant economic status of the USA, especially the California economy has sustained the continuous influx of global talents. These combined together to create this innovative environment in the Silicon Valley.

I believe the Korean clusters are situated in between the Scandinavian model and the Silicon Valley model in terms of their open strategies. The Silicon Valley model[1] and the Scandinavian model[2] tell us various lessons for our cluster creation paths such as institutions for the continuous experimentation of creativity of Silicon Valley and the strategic positioning of Scandinavian model and platform leadership strategy to induce continuous influx of global talents for their own competitiveness. It is, however, necessary to recreate the distinguished Korean models of CGICs, which is different from other cases and can be contextualized in a Korean environment.

3. Prerequisite: Challenges and Requirements

From the last couple of decades of fast economic growth, Korean economy has achieved two pillars of innovation system in Korea; the strong engineering systems centered on a few *chaebols,* large conglomerates, and the continuous experimentation of IT related services and contents industry. Both have their own strengths and weaknesses. The envisioning of the potential models of Korean CGICs is inevitably based on these inherited assets and legacies.

The *chaebol* system has been nurtured by the so called developmental state model which traces back to the 1970s' strategic industry promotion of the former president Park government. The elite bureaucrats and their favored entrepreneurs have worked together to create a very competitive production system in Korea. This system has proven its system competitiveness to produce quality products in reasonable prices for the global market so far. It has also displayed its distinguished adaptation capabilities to continuously change its top exporting products in the changing global market. Textiles in 1970s, electronics in 1980s, semiconductor in 1990s and mobile phones in 2000s

are a few of the top export products in each era.

Previous and current success might be a hindrance for future success. Even the Finnish system which was admired by its discipline, flexibility, and efficiency to refine core technologies relentlessly and to introduce them into successful products is at the risk of becoming a victim of its economic success (Sabel and Saxenian, 2008). Likewise the Finnish system, the successful Korean system, however, is claimed to be bottlenecks for nurturing the dynamics of small and medium sized technology companies. The power imbalance between the two parties of large assemblers and small and medium sized suppliers hinders the continuous encouragement of technology investment of suppliers.

As quite many of the large Korean companies become leaders in the global technology market, the previous mechanism of reverse-engineering is not working and they need to develop their own surviving models to develop new technology products mostly with strategic partnerships with out-of-house players. The strategic changes of large companies become strong challenges and opportunities to the domestic suppliers in Korea. The long lasting contract supplier relationship cannot be guaranteed on the one hand but, those technology suppliers are required to strive for their own survival strategies to enter global markets. This requires continuous networking with other technology suppliers on the other hand. The latter might be the opportunities to have domestic institutional settings of indigenous technology dynamics to induce external technology resources for innovation.

The Gumi mobile cluster (Lee, et al, 2006, 2007) describes succinctly the challenges and opportunities the Korean supply system deploys at the moment. Gumi was established as an industrial complex by the central government, whose major industry was electronics.[3] Samsung has contributed to the development of the local industrial cluster since it established a branch plant producing electronics products in the 1980s. The branch plant later began to produce mobile handsets. Gumi' s mobile cluster started to flourish from 2000, owing to the expansion of Samsung Electronics Company' s outsourcing strategy. Firms in Gumi' s regional innovation system mostly manufacture GSM-type cellular phones for all overseas markets, as planned in the Capital Region headquarters according to Samsung' s production strategies.[4]

Highly dependent on the central planning of Samsung Electronics Company from the outset, the mobile cluster in Gumi lacks autonomy, and thus Gumi suppliers have been having difficulty in developing self-sufficient regional innovation networks of their own. In this context, the potential challenge for Gumi is to prepare for the possibility of Samsung Electronics Company relocating their production centers to more cost-effective overseas locations such as China or Vietnam. The Gumi region is already facing the challenge resulting from Samsung' s international outsourcing and the concomitant reduction in the number of domestic Korean orders to Gumi' s local suppliers since 2004. This brought a harsh environment for local suppliers to compete for transaction orders.

Facing the challenge of Samsung' s international outsourcing and reduction of orders, most of the suppliers are trying to develop a few new products such as portable multi-media player (PMP), or enter new H/W or S/W solution markets. There have been little collective efforts to cooperate with each other since most of the suppliers only had contract relationships with Samsung. Very recently, however, the suppliers began to recognize that the technologies other suppliers have accumulated can be very useful for the

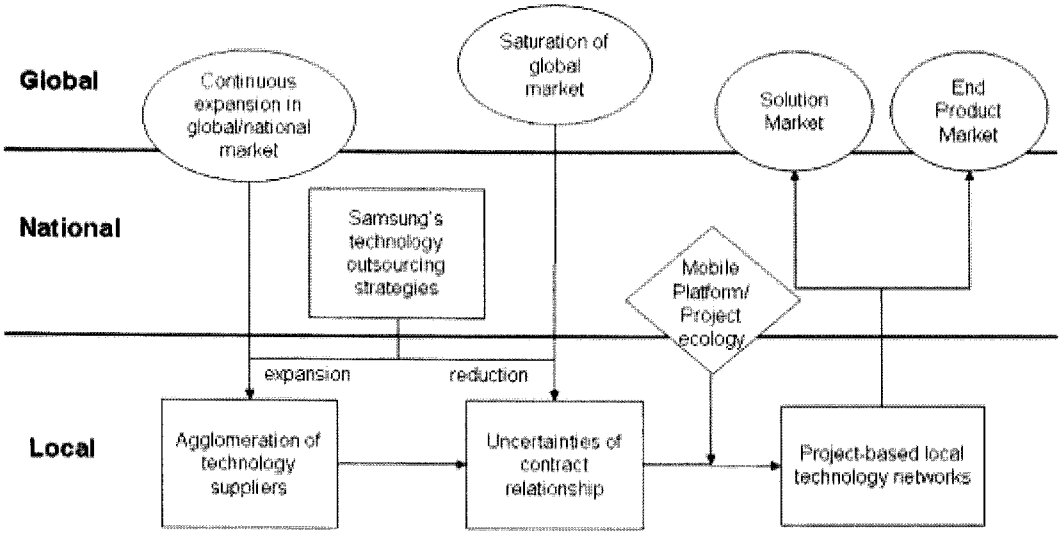

Figure 3. Transformation of Gumi mobile cluster in a multi-scalar framework

Source: Lee and Kim (2008)

development and enhancement of their own products and technologies. I expect adequate policy intervention should trigger the formation of the collective networks and project ecology (Grabher, 2005), which provides social and organizational fabric for temporary and recurrent project collaboration of core capabilities (Figure 3).

On the other hand, Korea is well known for the continuous experimentation of new services and contents of IT industry. The dense population and their living in apartment complexes are said to be the triggering infrastructure of the IT industry in Korea. In this living environment, the optic cable could be installed in cheap price and the critical mass market for new IT technology services and contents could be easily created through various channels of mimicking and benchmarking. New kinds of IT services and products have been experimented not only by Korean producers but also from other global producers. Korea especially the Capital region was introduced as a test-bed market of new IT products and services in the world, which also expend to include other kinds of products of cosmetics, etc.

The promising IT services and contents are confronted with the limits to growth. Most of their markets are confined to the Korean domestic market, which is sufficient for experimentation but not sufficient for dominating global market. This requires the Korean IT service and contents producers to create new markets through rearranging existing markets. The huge Chinese market is always considered as a stepping stone for the new market creation. These new adventure is totally different with the previous path of Korean economy, which was normally based on the mass production system. New ways of cultivating human resources and institutional settings to enhance creativity not only to develop their technology services and products but also to make new business models for their technologies are required.

4. RIS Policy Tools and Programs: Achievements and Limits

A nationally balanced development was one of the most important policy goals of the Korean government for the past ten years. And diverse regional innovation programs and strategies are at the center of the balanced development policies. Promotion of four target industries, so called 'strategic industries' in seven metropolitan cities and nine provinces (Table 1) through infrastructure building, R&D support, human resource development and coordination & networking support has been major policy goals of Korean RIS policies (Table 2) (Park, 2007). These policy programs and tools were initiated by the central government.

Besides these RIS programs and tools, two major programs to create innovation clusters in Korea were also implemented in the previous government.

- transformation of seven industrial complexes to innovation clusters through R&D capability enhancement of the district manufacturers with open networks among industries, universities, research institutes and government and improvement of residential & working environment of the districts
- creation of a technology cluster through promotion of new firm spin-offs and technology transfer from public and private research institutes which have agglomerated since early 1970s in the Daedeok Science Town

Table 1. Target Industries of 7 Metropolitan Cities and 9 Provinces

		Target Industries
Cities	Seoul	Digital Contents, IT, BT, Finance
	Busan	Seaport Logistics, Machinery Parts, Tourism & Convention, Film & IT
	Daegu	Mechatronics, Electronic & Information Devices, Textile, BT
	Incheon	Logistics, Automobile, Machinery & Metal, IT
	Daejeon	IT, BT, Parts and Materials, Mechatronics
	Gwangju	Photonics, Information & Electric Appliances, Automobile Parts, Design and Culture
	Ulsan	Automobile, Shipbuilding & Maritime, Precision Chemistry, Environment
Provinces	Gyeonggi	IT, Life Science, CT, International Logistics
	Gangwon	BT, Medical Equipment, New Materials & Disaster Prevention, Tourism & Culture
	Chungbuk	BT, Semiconductor, Mobile Communication, Next-generation Battery
	Chungnam	Electronics and Information Devices, Automobile Parts, Culture, Agriculture and Livestock
	Jeonbuk	Automobile and Machinery, BT, Alternative Energy, Culture & Tourism
	Jeonnam	BT, New Material & Shipbuilding, Logistics, Culture & Tourism
	Gyeongbuk	Electronic & Information Devices, New Materials & Parts, Herbal Medicine, Culture & Tourism
	Gyeongnam	Knowledge-based Machinery, Robot, Intelligent Home, BT
	Jeju	Tourism, Health & Beauty Bio, Environment-friendly Agriculture, Digital Contents

Table 2. Major RIS Policy Programs & Tools

	Policy programs & tools
Infrastructure building	Techno-parks, Regional industry promotion centers
R&D support	Increase of regional government R&D share from 27% in 2003 to 36% in 2006, Regional innovation centers in universities, Regional R&D clusters,
Human resource development	Regional industry related human resource development through NURI program
Coordination and networking	Regional innovation councils, Regional innovation agencies, Networking of industry, university and research institute through key universities program and technology transfer

Typified model of RIS policy intervention is described in Figure 4. This model is for the large manufacturer-centered region, mostly Southeastern regions in Korea. Local universities and research institutes which have various government R&D funds are required to cooperate with Techno Parks and Regional Industrial Promotion Centers to support local SMEs. Regional Innovation Agency is commissioned to coordinate the networks of the innovation actors in the region. SMEs are expected to produce more qualified goods to supply for the local assemblers or encouraged to find other customers in and out of the region.

Regional actors are characterized as being weak in innovation capability and they are not complementary among themselves. During the past rapid economic growth, regional public/private actors in Korea have been just controlled by the headquarters in the Capital region and these legacies of fast development have constituted the current characteristics of regional actors. The Korean RIS policies of the previous government can be summarized as capacity building of the RIS actors with research grants and infrastructure building and their complementarity enhancement through various networking and coordination programs (figure 5). By the support of the central government, local universities

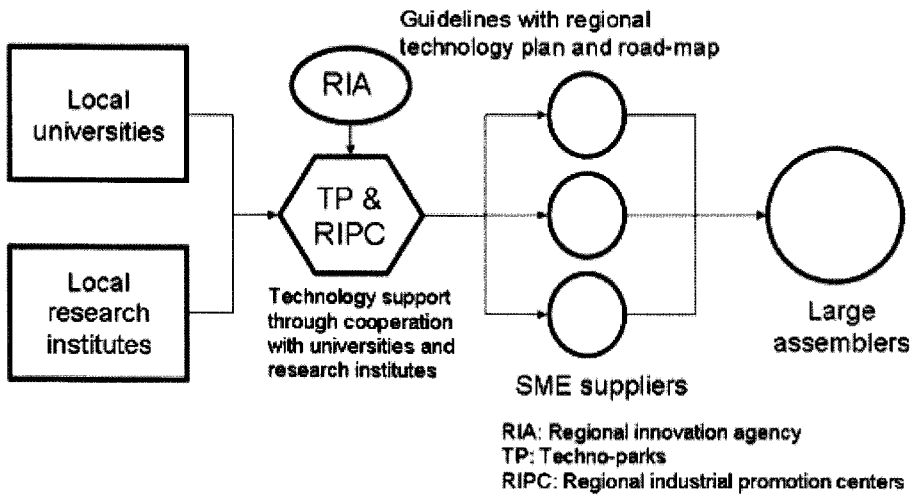

Figure 4. Typified model of RIS policy intervention in Korea

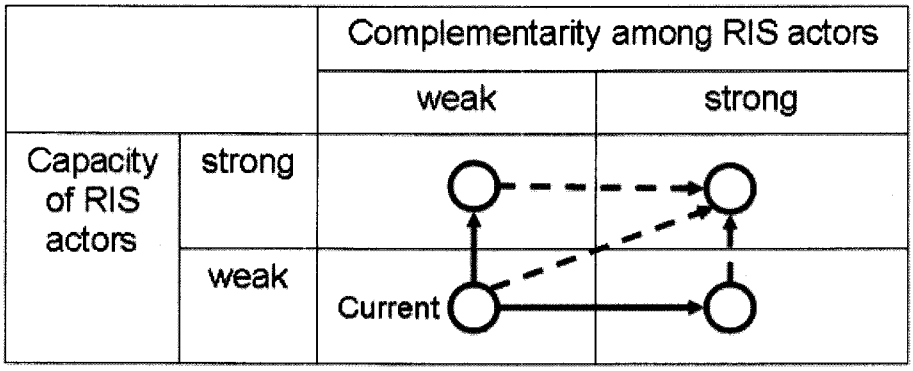

Figure 5. Expected path of Korean clusters

Note: ------→ (potential results of policy intervention)
——→ (direct results of policy intervention)

and research institutes began to produce various technologies for industry through R&D activities. R&D infrastructures of techno-park and industrial promotion centers were established in the region and are doing facilitating roles of technology support for local SMEs.

Therefore it may be said that there was a certain rationale to pursue these kinds of RIS policy programs and tools in the previous government. The RIS policy interventions, however, have shown very limited achievements. Limited capacity building and partial interactions does not guarantee switching to the target status of strong capacity and strong complementarity. It is not sure that the capacity building of local actors and their coordination and networking activities can contribute to the development of a dynamic endogenous innovation system in the region. The legacies of a developmental state model still hamper the successful transformation of the region; dominance of central government on the whole regional innovation policy planning and execution, power imbalance between large chaebols and local suppliers, and lock-in effects by the local stake-holders.

5. Cluster Policies for the Large Economic Zones Approach

To overcome the limits of the previous government's RIS policy, current government pursues 5+2 large economic zones (광역경제권) approach which is supposed to enact next year. The main idea of the large economic zone is based on the scale economy. The previous and current RIS programs and tools were bound to be installed in the incumbent seven metropolitan cities and nine provinces. This administrative constraint has resulted in the scale economy problem. Besides the Capital region of Seoul and Gyeonggi, no region has sufficient economic size to pursue efficient regional innovation policies. So the current government tries to compensate current policies with the large economic zone policies. In this new policy framework, two or three adjacent metropolitan cities and provinces are encouraged to plan and execute their shared RIS policies.

This complementary approach sounds reasonable. In the glocalized economy, the minimum size of population and economy of a region as market and production base is to be more than five million

populations depending on various analysts. To be successfully prepared in the competing environment, locality should attract major global production networks. Quality of life with good health care, education and infrastructure of enhancing accessibility requires scale economy, which is created based on combining adjacent centers and peripheries.

Cluster phenomena, however, can not be captured by this adjacent spatial binding. OECD argues that clusters are not correctly matched with the existing administrative boundaries (Guinet, 2003). They are sometimes inside or beyond of the boundary, overlapping two or three administrations. Another important finding of cluster study from the global production network studies tells that cluster phenomena are spatially leapfrogging. Local industrial entities are considered part of a large global production networks (Barthelt, 2003). Adjacency is meaningless in most industrial value chains.

If the compensatory large economic zone policy has the same policy tools of research grant, infrastructure building, and networking, the policy will result in the policy failure because of various issues of mal-governance. Just expansion of the current administrative boundary of RIS policies is not working to transform current local production system to be innovation clusters.

It is required to create a new approach based on the diagnosis of current policies. The most important problem of the current policies is related with the lack of industry participation, especially large companies. The government RIS policy has not covered all the value chain of the target industries but, only a few companies have been enjoying the public assistance. On the other hand, some of the regional centers and agencies are performing well even though they are not supported with sufficient resources. The new approach is how to trigger current qualified agencies to contribute to the specific industrial needs and other ill-functioning organizations to be transformed to be efficient or to be discarded.

To solve these problems, I would like to suggest a certain policy framework to establish various cluster consortia, of which program is to be coordinated at the national level. To facilitate the participation of large companies in the cluster policies, the new and compensatory cluster policies are required to consider the specific necessities of industries. One of the best ways to reflect the industrial needs in the cluster policies are to encourage various cluster members to establish their issue based consortia. Companies in a certain industrial complex may initiate their consortia but, these don' t have to be confined in administrative boundaries. Various organizations can be mobilized not only from the locality but also from other places including global resources. For the automotive cluster issues, regional automotive research centers in Ulsan, Gyeongbuk and Daegu may cooperate with Korea Automotive Technology Institute in Chungnam to solve various cluster issues of technology, management, marketing, etc. This kind of national level consortium can be generated with the strong participation of large companies and their major suppliers. As these consortia play a guiding role to connect public research/management centers and agencies with large companies and their suppliers, the poor public actors which cannot organize/participate in the consortium may be induced to be transformed.

6. Cluster Policy as a Platform to Experiment Collective Responses

From the discussion of theoretical CGIC models, the prerequisite of Korean cluster formation and the critical

review of the previous government' s RIS policy programs and tools, followings are to be considered as further steps for the cluster formation in Korea.

First, Korean models of global leading clusters (Park, 2007) are required to be experimented through the cluster policies. As discussed, it is necessary to establish distinguished institutional models to create a minimum critical mass and diversity of a region to continuously induce external resources for its innovation. Transplantation of advanced system is not realistic in Korean context because it is not developed as a part of global production network but has developed its own domestic production networks (Lee, forthcoming). To trigger the transformation of the current system, 'brain circulation' (Saxenian, 2006) strategies are to be considered. The transplantation of business networks which are embodied in talented persons who have successful experiences abroad has been growth engines of clusters in China, India, Taiwan and Israel.

Second, the inherited assets and resources which have been nurtured during the rapid economic growth and informatisation should be efficiently utilized to formulate the Korean distinguished model. The engineering capabilities and networks among the large companies and their suppliers should be enhanced. Creative human resources and institutional settings are required to be prepared to mobilize diverse resources to develop new technology products and to make new business models to commercialize their products in the newly created global markets.

Third, the cluster policy should be considered as a platform to experiment various institutional settings to create their distinguished models. Through the last ten years efforts of regional innovation, many kinds of R&D infrastructure have been established through out the country. Some of them began to contribute to the regional technological problem solving and facilitate the complimentary relationship among the local actors. These policy efforts, however, are not sufficient to create a critical mass for the indigenous technological dynamics. Local companies, especially large companies are not actively participating in the program.

Fourth, the new cluster policies are required to trigger the place specific institution building process. Each locality has its different rationale of policy intervention. The new policy needs to accommodate these diversities. For instance in the case study of Gumi mobile cluster, the cluster policy may provide a platform to enhance collaborative environment for the H/W and S/W developers to formulate horizontal networks with other knowledge creators and companies and to develop their own end market products and solutions in the global market.

Lastly the appropriate macro framework conditions are to be sustained for the creation of innovation clusters and the cluster-based industrial development (UNIDO, 2003). The macro framework conditions may include transparent and high-level political system, macro-economic stability, fair legal system, steady industrial and investment policy, supportive financial system, simple and low-cost regulation. Especially as we pass through the serious currency turbulence triggered by the global financial turmoil, these macro conditions should be given more policy concerns.

I am not sure that there are certain innovation clusters in Korea, but I may say that there are certain necessary and sufficient conditions constituted to generate innovation clusters. As the new government policy triggers the collective responses of regional actors to work together for the development of new technology products, Korea may have the competitive

global innovation clusters in near future. Gumi cluster with Samsung and LG and Ulsan cluster with Hyundai sound more powerful than Oulu with Nokia and Kista with Ericsson. I expect these policy approaches are facilitating the creation of innovation clusters in a developmental state model country which has been dominated by large companies and central government.

Notes

1) On the other hand, the Valley suffers from high living costs. It cannot accommodate any low income jobs in the region. So the low income economy should be kicked out of the region. Major companies have already moved out their production functions and sometimes even research activities. Some of the companies are only based on planning, marketing and other non materialistic business activities. Deindustrialization, globalization and outsourcing (Whitford, 2006) is also the secret of the Silicon Valley prosperity. Because of this process, the region continues to loose its job opportunities, which hampers the middle class in USA as important market and labor resources. As we are confronted with the global financial turmoil at the moment, which was triggered by the American economic system, we need to reconsider the appropriateness of Silicon Valley model as our utmost goal.
2) The Scandinavian model was also recommended by quite many scholars and policy makers as our potential paths of clusters. I believe the difference of economic size between the two parties makes it not realistic. The Scandinavian economies are less than ten million population economies. This small size economy has led their economies to develop their own distinguished model. But this is always fragile against external changes. For example the ship building industry of Sweden was demolished in late 1970s and early 1980s because of the expansion of Japanese and Korean shipbuilding industry. The Volvo passenger car was sold out as Hyundai began to expand its global market share. Ericsson is also threatened by Samsung and LG. The Swedish telematics project to utilize the inherited automotive and electronics technologies in the abandoned shipbuilding site was also threatened as Korean government took the telematics industry initiative as one of its strategic industries in 2003.
3) This industrial complex was established to promote electronics industry in Korea as one of the six strategic heavy and chemical industries of the 1970s and 1980s of the previous government of Park.
4) The Korean domestic cell phone market is dominated by CDMA, not GSM. GSM products for export, supplied by Gumi' s regional innovation system, amount to about 73% of output. CDMA products are manufactured mainly in the Capital Region (Lee et al., 2006).

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