FOSTERING INNOVATION IN HI-TECH CLUSTERS

PROCEEDINGS AND PAPERS PRESENTED AT THE WORKSHOP ON FOSTERING INNOVATION THROUGH STRENGTHENING OF HI-TECH CLUSTERS

UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

Asian and Pacific Centre for Transfer of Technology (APCTT)

The Asian and Pacific Centre for Transfer of Technology (APCTT), a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives: to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.

The shaded area of the map indicate ESCAP members and associate members

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New Delhi, India

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ABBREVIATIONS

ANT	Advanced Nanotechnology Ltd.
APCTT-ESCAP	Asian and Pacific Centre for Transfer of Technology (of the Economic and Social Commission for Asia and the Pacific)
APEC	Asia-Pacific Economic Cooperation
EPO	European Patent Office
ESCAP	Economic and Social Commission for Asia and the Pacific
FDI	Foreign direct investment
GDP	Gross domestic product
HDD	Hard disk drive
HGST	Hitachi Global Storage Technology
HTC	Hi-tech cluster
ICT	Information and communication technologies
IDEMA	International Disk Drive Equipment and Materials Association
IP	Intellectual property
IPO	Initial public offering
IPSI	Institute for Industry Policy and Strategy
IXC	Innovation Exchange
KComs	Knowledge communities
KMkts	Knowledge markets
KOrgs	Knowledge organizations
MOIT	Ministry of Industry and Trade
MOST	Ministry of Science and Technology
MNC	Multinational corporation
MNE	Multinational enterprise
NIS	National innovation system
NISTPASS	National Institute of Science and Technology Policy and Strategy
NSTDA	National Science and Technology Development Agency
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organization for Economic Cooperation and Development
R&D	Research and development
RIA	Regional Innovation Agency
RIPC	Regional Industrial Promotion Centre
RIS	Regional innovation system
S&T	Science and technology
SIS	Sectoral innovation system
SME	Small and Medium Enterprise
STEPI	Science and Technology Policy Institute
STIP	Science and Technology Industrial Park
TFIA	Thai Furniture Industry Association
UWA	University of Western Australia
WTO	World Trade Organization

PART ONE

REPORT OF THE WORKSHOP ON FOSTERING INNOVATION THROUGH STRENGTHENING OF HI-TECH CLUSTERS

I. ORGANIZATION OF THE WORKSHOP

A. Objective

The Asian and Pacific Centre for Transfer of Technology (APCTT), a regional institution of the Economic and Social Commission for Asia and the Pacific (ESCAP), in 2009 implemented a project "Innovation systems and support mechanisms for promoting high and emerging technology in the Asia-Pacific region" to meet the expressed needs of the countries of Viet Nam and Sri Lanka. A two-day workshop on Fostering Innovation through Strengthening of Hi-Tech Clusters, from 9 to 10 November 2009 in Hanoi, Viet Nam was organized by APCTT-ESCAP in cooperation with the Ministry of Science and Technology, Government of Viet Nam, and the National Institute of Science and Technology Policy and Strategy (NISTPASS), Viet Nam. The objective of the workshop was to enable key actors involved in the structuring and management of the national innovation system (NIS) of Viet Nam (a) to understand the role and importance of hi-tech clusters (HTCs) in nurturing innovations; (b) to formulate strategies, policies and management practices to strengthen hi-tech clusters and promote the industrial application of innovations generated; and (c) to provide a unique platform for policymakers and innovation-related experts to exchange their experiences and good practices.

B. Attendance

The workshop was attended by senior officials from key ministries, R&D institutions, universities and technology transfer intermediaries from Viet Nam. The list of participants is attached as Annex I.

Representatives and experts from APCTT-ESCAP and the project consultant dealt with contemporary issues and challenges with regard to open innovation, structuring NISs, HTC analysis and factors influencing the development and growth of HTCs.

Resource persons from China, Hungary, India, Republic of Korea, Viet Nam and Thailand shared national experiences in the promotion of HTCs to enable the participants gain insights into best practices associated with HTC development in.

C. Election of officers

The following people performed as moderators to chair each session and to serve as officers:

Moderator (Session I):	Mr. Tran Ngoc Ca (NISTPASS, Viet Nam)
Moderator (Session II):	Mr. K. Ramanathan (Head of APCTT-ESCAP)
Moderator (Session III):	Mr. N. Srinivasan (APCTT-ESCAP)

D. Programme

The workshop proceeded as per the programme attached as Annex II.

II. OPENING OF THE SESSION

At the outset, Mr. Mai Ha, President of National Institute of Science and Technology Policy and Strategy Studies (NISTPASS), Government of Viet Nam, gave the welcome remarks.

Mr. Ramanathan, Head of APCTT-ESCAP, delivered the opening statement. He welcomed the participants to the workshop and thanked Mr. Ha for delivering the welcome statement. He also expressed appreciation to NISTPASS for the cooperation in and contribution to organizing this important event. He further extended his heartfelt thanks to all speakers. He expressed the hope that the workshop would be able to give a good insight into HTCs.

Mr. Nguyen Thanh Tung, NISTPASS, Viet Nam, then made the introductions at the workshop. He pointed out that the workshop would be very useful for the participants and Viet Nam could benefit very much from the experiences of other countries. In his closing remarks, Mr. Tung welcomed all participants to the workshop and wished that the event be a constructive opportunity to exchange the knowledge and valuable experiences on strengthening HTCs among the Asia-Pacific countries.

Unfortunately, two presenters could not attend the workshop. Mr. Zhou Ding [Torch Hi-Tech Industry Development Centre, Ministry of Science and Technology (MOST), Beijing, China] could not participate in the event owing to medical reasons. Ms. Truong Shi [BINH, Institute for Industry Policy and Strategy (IPSI), Ministry of Industry and Trade (MOIT), Viet Nam] could not be present and was represented by her colleague Mr. Hoang Kim Huyen.

After the opening session, there were presentations in the successive three sessions.

III. CONSIDERATION OF ISSUES

A. Overview

Innovation has an important role in national economies. In order to achieve innovation-driven economic growth, the Innovate America report published in 2004 suggests: (1) ensuring human resources for innovation; (2) support through investment on the development of 'Innovation Hot Spots' and on the upgrading of R&D investments; and (3) improving infrastructure such as intellectual property (IP) system and manufacturing base.

According to the definition by Mr. Michael E. Porter, "Cluster is geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions in particular fields that compete but also cooperate." Clusters are drivers of prosperity in a global economy. Promotion of cluster formation could strengthen the local competitiveness. Clusters are able to help small and medium enterprises (SMEs) strengthen and stay competitive in the national economy.

Typically HTCs are aimed at promoting innovation in new and emerging areas like nanotechnology, information and communication technology (ICT) and biotechnology. Other – not typically hi-tech – clusters are: chemical industry, functional food industry, biofuels, automobile industry, electronic device manufacturing, pharmaceuticals industry, space flight, chemical industry, etc.

B. Session I: HTCs and systems of innovation

The session began with Mr. Ramanathan speaking about the international R&D settings and open innovation. He said that R&D programmes in knowledge-intensive economies had begun to rely heavily on open innovation (sometimes called "collaborative innovation"). As a result, collaborative efforts in hi-tech development both within and across borders had increased, and there was a great desire among R&D institutions, industry and universities to work together. He presented some case studies to show that open innovation can be practised in a number of ways.

Mr. Srinivasan, in his address, spoke about the NIS. He pointed out that the purpose of the NIS exercise was to understand innovation eco-system and factors that stimulate innovation and develop a framework for formulating a national and/or company innovation strategy. According to him, as regards implementation, the focus needed to be on introduction of new policies and initiation of new programmes, re-orientation of ongoing programmes and re-direction of ongoing strategies and management. He pointed out the inter-relationship between government policy settings and innovation eco-system, and presented efforts of APCTT-ESCAP in promoting NIS in the Asia-Pacific region.

Mr. Peter Mogyorosi from Hungary presented the role of HTCs in NIS. He highlighted the three spheres of the Triple Helix Model. He clarified the differences between the national, regional and sectoral innovation systems. In the life of HTCs, there were macro factors that looked at the external business environment and they provided an appropriate strategic tool for understanding the external environment.

There were several principles of cluster-based economy development in practice in the European Union. Mr. Mogyorosi presented the European mix of regional and national cluster policies and the cluster accreditation procedure. The original focus of cluster development policies in Hungary seemed to have been the development and strengthening of a more decentralized industrial policy, he said. Thus, the results of cluster policies in Hungary in the past could not be seen only in the light of innovation policy but more as another regional development tool.

The presentation from Ms. Troung Chi of Viet Nam described the features of industrial agglomeration and the situation of spontaneous industrial cluster in Viet Nam. In Viet Nam, the industrial agglomeration was concentrated in Hanoi and surroundings and in Ho Chi Minh and surroundings, she pointed out. Statistically, the comparative advantages were location, local investment, policy, cheap labour, market and input proximity. The industrial cluster model in Viet Nam had some requirements: development of supporting industries and supply system needed to be strengthened, and that would enhance the local industry, particularly the capacity of SMEs. There was only a very small amount of support from the authority, organizations and associations for developing HTCs. The presentation also provided the road map of industrial cluster development in Viet Nam, in three phases between 2009 and 2015.

C. Session II: Development and management of HTCs – experiences, lessons and best practices

Mr. Jeong Hyop Lee from the Republic of Korea explored the conditions of switching forces to create innovative clusters in the Republic of Korea. He identified the switching forces and conditions of four Korean clusters, and pointed out to the possibility of the transformation to the innovative clusters of horizontal networks. He introduced the Gumi Mobile Cluster (one of the four Korean cases) and examined this through multi-scalar quantitative and qualitative analyses.

In the case study of Gumi Mobile Cluster, Mr. Lee explained that the subcontracting companies of Samsung mobile phone were at present trying to formulate horizontal networks. Most of them had grown rapidly in size and possessed certain key technologies through their strong partnership with Samsung. The agglomeration of these technologically strong companies in the area could be traced back to the strategic change of Samsung, he said. Samsung (which was leading the technology market of mobile phones at present) had adopted and continuously expanded outsourcing strategies not only for components and parts but also for the development of hardware and software of mobile phones because of market and technology uncertainties. The potential crisis that might be driven by Samsung had confronted technology companies and triggered them to develop their own market products and search for horizontal partnership with other technology companies.

Mr. Somchai Chatratana from Thailand presented the development of hard disk drive (HDD) cluster in Thailand. The HDD industry was one of Thailand's most important industries since 2005, he informed. Thailand had supplied nearly half of the world's HDDs. Thailand's total computer components exports (including HDD) were valued at US$17 billion and that would continue to prosper, he said. The competitiveness of Thailand's HDD industry was derived from a deep HDD network of world-class supporting industries that manufactured parts of final HDDs.

The number one position among HDD exporters had moved from Singapore and China to Thailand in the past years. In 2004, Thailand gained 19.9 per cent world market share of HDD production with an export value of 483 billion baht (while imports were valued at 280 billion baht). The value added from this industry was 187 billion baht, which accounted for 3.2 per cent of the GDP. The industry offered 93,000 jobs.

Mr. Mogyorosi from Hungary presented the new issues in HTC analysis. He described the five stages (which can be identified in the process of cluster formation) and the procedure of cluster development, and also listed indicators for assessing the performance of HTCs. He presented selected case studies on performance analysis and assessment of HTC.

The first Hungarian cluster was the Pannon Automotive Cluster (PANAC) established in 2000. It attracted many automotive SMEs (aspiring to become suppliers) because of the proximity of multinational enterprises (MNEs). The SMEs soon realized that without cooperation, most of them would not achieve supplier status. Another example was the Pharmapolis Innovative Pharmaceutical Cluster in which the Richter Gedeon Pharmaceutical Company – the most important pharmaceutical stakeholder of the cluster – carried out closely aligned R&D activities in the field – primarily clinical research.

D. Session III: Role of national government and international agencies in facilitating cluster development

The presentation prepared by Mr. Zhou Ding of China examined the status, policy measures and the role of the Chinese National Science and Technology Industrial Parks (STIPs). At the end of the last decade, the central government of China had outlined several strategic tasks for building an innovation-oriented country. The strategic importance of innovation-related clusters led China to confront issues of promoting cluster development and upgrading. Recently, the Ministry of Science and Technology (MOST) embarked on a new mission to build innovation clusters.

As a national strategic plan, the national STIPs have made several achievements in both economy and innovation. Though China's focus was on building an innovation-oriented country, it was faced with challenges in the development of national STIPs. The presentation also dealt with the initiation of construction of STIPs and showcased several key issues in their development.

Mr. Lee from the Republic of Korea pointed out that the Republic of Korea was referred to as a successful model of a developmental state. The dominating power of large companies, combined with the autonomous and efficient coordination capacity of bureaucracy, had been the growth engines of the rapid economic growth of the Republic of Korea. The legacies of the developmental state had strong influences on the way large companies organize their production networks, he said. The power structure between large companies and their subcontractors had been accused of being a bottleneck for the smooth transition to an open and continuous experimentation of creativity in locally embedded horizontal networks, which crystallized the essence of innovation clusters.

Mr. Chatratana from Thailand explained that wood and furniture were two industries in which Thailand had many competitive advantages. The textile industry played a significant role in Thailand's economic and social development. That diverse and heterogeneous industry covered a wide variety of products, he informed. . During his presentation, Mr. Chatratana spoke about the development of Sub-Sector Innovation Network, how it could be established and sustained, and how the connections between sectors might lead to cluster formation. Towards the end, he described iTAB-conducted programmes to develop the competitiveness of wood and furniture industries.

IV. CONCLUSIONS AND RECOMMENDATIONS

It is hoped that the workshop would provide valuable insights into the thinking and developments taking place in the Asia-Pacific region so that collaborative efforts among countries in the region could be explored. This workshop provided a platform for the exchange of experiences and sharing of ideas among the six countries that were represented. Besides those explored thus far, there would be many more that would be covered during presentations by the resource persons and the country delegates.

An enterprise could react to the changes of the business environment through innovation. A cluster could be regarded as an innovative formation if it generated and commercialized new ideas, found more efficient production processes or created totally new markets. Through innovation, enterprises were able to build a strong cluster but imitators and

competitors always appeared. Having imitators was very important because that stimulated the clusters to find further innovative solutions so that the information circulated among themselves. That was the reason why companies needed to look for benchmarks among others.

In the last decade, there was a feeling that the Asia-Pacific region would come up to the front line with dramatic speed. This was particularly true for the hi-tech sector, one of the most dynamic and globalized industries in the world. Hi-tech also existed in the level of clusters. HTC was a knowledge-based entrepreneur formation. Knowledge-based clusters could be among the main levers to foster competitiveness in the Asia-Pacific region in the knowledge-based economy. Collaboration and effective sharing of knowledge were key attributes of the hi-tech industry.

A major issue in the workshop was how to define the differences between a HTC and an industrial park. Although geographical proximity in industrial parks and innovative clusters was identical in practice to a certain degree, the origins of the two concepts were completely different. The construction of industrial parks had been identified by the government as an important incentive and as an infrastructural investment capable of attracting enterprises from outside and creating jobs, whereas clusters were emerging as generators of new firms from inside. It was still a long way to build innovative clusters in industrial (or science and technology) parks (creating hi-tech zones).

Open innovation was also discussed during the workshop. Some characteristics of open innovation were mentioned during these discussions. First of all, enterprises had to recognize that not all smart people in the field work for them; enterprises needed to work with smart people from both inside and outside the company. A key concept was that enterprises did not have to originate the research to profit from it.

Clusters helped regions better understand how their economies functioned as systems and which policy levers were likely to be of the greatest impact. Thus, actions were needed for understanding and benchmarking regional economies. Some countries from the Asia-Pacific region could learn from the European model regarding cluster policy. Generally, these were policies of the central government and autonomous local governments and needed to be followed by provinces in the country. Clusters at bloc (such as the European Union), national and regional levels needed to support and strengthen each other. Although clusters were predominantly a regional or national phenomenon, cooperation at the bloc level could contribute in a number of ways to their success, as noted by the Competitiveness Council. Competitiveness and innovation programmes allowed for the implementation of cluster-supportive actions, including support for policy cooperation and mutual learning for excellence in national and regional administrations.

The general problem between policy development and execution was the low level of integration. Clusters needed a common policy framework that enabled cluster emergence, supported cluster initiatives and connected clusters through transnational cluster cooperation and exchange.

To strengthen HTCs, countries needed to:

- Encourage R&D activities and step up establishment of high-level R&D organizations;
- Set up innovation service organizations;

- Develop high-level technology service industries and establish innovation service supportive systems;
- Attract social capital by setting up investment-oriented capital for business establishment, limited partnership investments in experimental units and new area technology industry funds; and
- Allow financial capital to take part in the transformation of the scientific and technological achievements.

PART TWO

BACKGROUND PAPER (I)

OPEN INNOVATION: THE EMERGING APPROACH FOR HTC DEVELOPMENT

BY

MR. K. RAMANATHAN,
HEAD, APCTT-ESCAP

I. THE INTERNATIONAL R&D SETTINGS

Worldwide, the R&D expenditure rose from US$377 billion in 1990 to US$810 billion in 2003 (unadjusted for inflation). The share of Organization for Economic Cooperation and Development (OECD) countries dropped from 93 per cent in 1990 to 82 per cent in 2005. Some highlights:

(1) Industrial versus government R&D spending:
- Industry R&D is growing, leading to a declining share of government support in total R&D in many countries.

(2) Cross-border R&D investments and alliances are increasing:
- Overseas R&D spending by the United States-based multinational corporations (MNCs) is increasing in Asia.

(3) China has become a large R&D performer:
- Chinese R&D spending went from US$12.4 billion in 1991 to US$115 billion in 2005;
- China's R&D/GDP ratio has gone from 0.6 per cent to 1.34 per cent; and
- China's industrial research workforce has gone from 16 per cent that of the United States in 1991 to 42 per cent by 2003.

(4) Europe and Japan are losing market share in hi-tech manufacturing:
- Traditionally, the United States, Europe and Japan dominated hi-tech manufacturing (aerospace, pharmaceuticals, office and computing equipment, communications equipment and scientific instruments);
- In 2003, China surpassed Japan and accounted for 12 per cent of world market share. The Asia-8 (the Republic of Korea, India, Indonesia, Malaysia, The Philippines, Singapore, Taiwan Province of China and Thailand) accounted for 12 per cent; and
- The United States leads with about 40 per cent share.

(5) Increasing Asian patent filings show growing technological sophistication:
- Patent applications in the United States from China and Asia-8 rose by 800 per cent over the period 1990-2003 and constituted nearly 20 per cent of all foreign-resident inventor filings in 2003; and
- The Republic of Korea and Taiwan Province of China have joined Japan among the top five inventor locations.

(6) Academic R&D has grown robustly and international collaboration is commonplace:
- Academic R&D spending has more than doubled globally over the period 1990-2003, but in China the increase has been much more – from US$1.1 billion in 1991 to US$7.3 billion in 2003;
- The publication share of China and Asia-8 grew from less than 4 per cent in 1988 to 10 per cent in 2003;
- By 2003, the Republic of Korea ranked sixth and China twelfth in terms of world article output; and
- In 2003, overall, about 20 per cent of the world's scientific output had authors from two or more countries compared with 8 per cent in 1988. Similar ratios are seen in Japan, China and Asia-8.

II. OPEN INNOVATION

There is a big change today in the way innovation is taking place. This change is being referred to as "innovating innovation". Towards the end of the twentieth century, the dominant industrial innovation model was known as "closed innovation". Principles that govern the closed innovation paradigm are:

- The smart people in our field work for us;
- To profit from R&D, we must discover everything ourselves, develop it and sell it;
- If we discover something first, we can market it first;
- The company that gets an innovation to market first will be the winner;
- If we create the most and best ideas in the industry, we will win; and
- We should control our IP very carefully and not give it out.

However, during the last decade of the twentieth century, several factors started making closed innovation irrelevant. These include the following:

- Growing mobility of experienced and skilled scientists and technologists leading to knowledge spill-over and leakage;
- In the developed West, private venture capital companies started setting up new ventures based on external research that became competitors to established firms and R&D institutions;
- Scientists and engineers working in established firms started leaving to set up ventures on their own, with the support of private venture capital companies, if their firm did not commercialize their "breakthroughs" in a timely manner;
- Decreasing technology life cycles; and
- Competition from all parts of the world due to globalization of business.

The erosion of the closed innovation approach has led to the emergence of a new paradigm called open innovation. Open innovation is based on the following principles:

- Not all smart people work for us. We need to work with smart people inside and outside our organization;
- Externally done R&D can create considerable value for an organization if the organization also has good internal R&D capacity to capture the value created by the external R&D;
- We do not have to originate the research to profit from it;
- While getting to market first may be good, what is even more important is building a better business model;
- If we make the best use of internal and external ideas we will win; and
- We should profit from others using our IP and should buy IP from outside to advance our own efforts and business model.

However, adopting an open innovation approach requires commitment to adopt some basic approaches, namely:

- Accessing useful knowledge globally;
- Accepting that now there is a new rationale for internal R&D; and
- Organizational architecture must be changed so that scientists and technologists can effectively adopt open innovation.

A. Approach I: Accessing useful knowledge globally

In this approach:

- Useful knowledge is found globally; and
- While internal generation of knowledge has to be supported, it is very important for organizations to become part of global knowledge networks to gain "access to resources".

Knowledge networks may be classified into three categories:

(a) Knowledge communities (KComs);
(b) Knowledge markets (KMkts); and
(c) Knowledge organizations (KOrgs).

(a) Knowledge communities:

- KComs consist of members, such as the science community, who subscribe to the concept of equitable participation in the acquiring and sharing of knowledge and information;
- Such communities grow out of practical need and are drawn together by a practical need. When a "collective benefit" is evident through the coming together of such a community, they tend to be supported by government, international agencies and business and professional associations; and
- Over time, with appropriate restructuring, a successful KCom could well evolve into a "knowledge market" for effectively commercializing research.

(b) Knowledge markets:

- KMkts are involved in the trading of commercially valuable knowledge between owners and seekers, often through Internet-based exchanges; and
- However, in today's context, intermediaries who act as ethical "knowledge brokers" are increasingly being used to accelerate commercialization.

(c) Knowledge organizations:

- KOrgs have emerged in parallel to KMkts and consist of entities that not only manage the relationship between creators and users of knowledge but also develop skills on the part of users to apply knowledge through specific interventions.

B. Approach II: Accepting that now there is a new rationale for internal R&D

Under the open innovation paradigm, it must be understood that internal R&D is now carried out for the following reasons:

- Identify, understand, select from and connect to the wealth of available external knowledge;
- Fill in the missing pieces of knowledge not being externally developed;
- Integrate internal and external knowledge to create higher value by developing new products, processes, systems and architectures; and

Box 2.1: Example of InnovationXchange

In 2003, the Australian Industry InnovationXchange (IXC) Network was formed with the support of the Australian Industry Group Sir William Tyree Foundation, the Australian Government and the State Governments of New South Wales, Queensland and Victoria. Its objective was to provide an on-line 'open network' to enhance Australian innovation by improving communication across the boundaries of industry, government, academia and research. InnovationXchange started as a KCom.

However, it was felt that the KCom approach did not address the issue of sharing potentially sensitive or confidential information between legally separate entities. Thus, in May 2004, IXC began to trial the use of 'trusted intermediaries' to facilitate secure, managed exchange of sensitive knowledge between entities. This marked the movement of IXC from being a pure KCom towards becoming a KMkt.

One of earliest successes of IXC was the establishment, in 2004, of a network called the Life Sciences Consortium consisting of businesses and public organizations with converging interests. These included companies such as IBM Healthcare, Johnson & Johnson Research, Walter & Eliza Hall Institute of Medical Research, the University of New South Wales and seven Melbourne-based listed companies (Acrus, Avexa, Amrad, Biota, Cytopia, Starpharma and Virax). With additional support from IBM, Johnson & Johnson and ResMed, the Consortium is being significantly enhanced and will be connected to other networks with converging interests in the medical devices, smart building and smart manufacturing sectors.

On 1 July 2006, IXC was officially established as IXC Australia Ltd., a fully independent, not-for-profit company. IXC Australia Ltd. has set up its United Kingdom operation, known as IXC UK, and is working with groups in Europe, South East Asia, North America, South America and the Pacific to expand the network. Simultaneously, IXC has also started working as a KOrg. One of its initiatives in Australia is the "Blue Sky Forum" that it conducts jointly with the Australian Institute for Commercialization. At this Forum, industry leaders speak to researchers about problems, challenges and "blue sky" opportunities in their sector.

(Sources: www.ixc.com.au and fastthinking.com.au)

- Generate revenue by selling research outputs to other organizations without compromising our own core competence.

C. Approach III: Organizational architecture must be changed so that scientists and technologists can effectively adopt open innovation

This approach requires some fundamental changes:

- Traditionally R&D was organized through deep vertical integration;

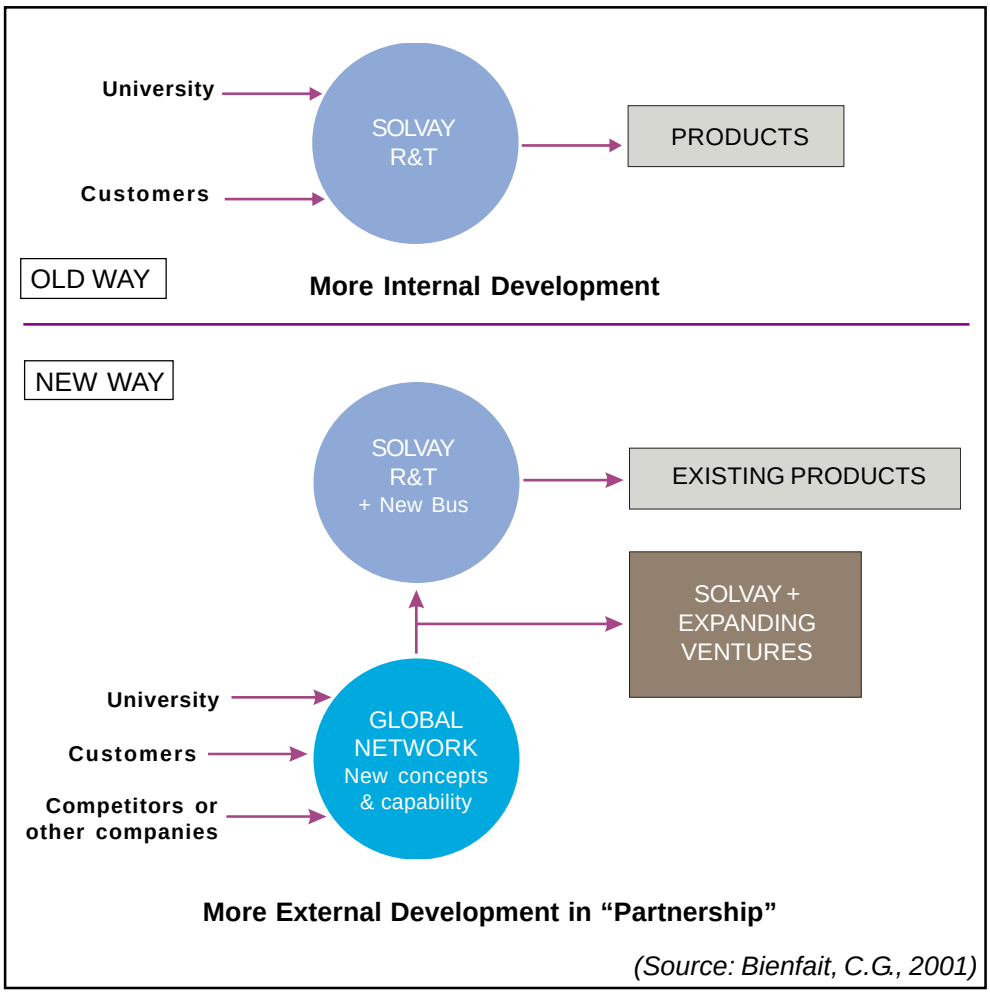
- This could become detrimental to the practice of open innovation;
- It is imperative for organizations to re-engineer their organizational architecture and make it flatter and modular to promote free interaction and sharing of information;
- Researchers must develop the confidence and skills to work with a range of external sources of knowledge and related entities; and
- Suitable job descriptions and incentive systems must also be developed and implemented effectively.

III. CASE STUDIES

A few case studies – Solvay, Apple, IXC and Advanced Nano – are presented to show that open innovation could be practiced in a number of ways. Actually, there is no one best way. What is important is to deploy the principles effectively behind open innovation.

A. Case Study 1: An example from Solvay

Figure 2.1: An example from Solvay



(Source: Bienfait, C.G., 2001)

B. Case Study 2: The example of Apple

The 30 GB fifth-generation iPod:

- Designed by Apple in California, the United States;
- Disk drives made by Toshiba, Japan;
- Display modules made by Matsushita and Toshiba, Japan;
- SDRAM memory made by Samsung, Republic of Korea;
- Video processors made by Broadcom, the United States;
- Final assembly by Inventec, Taiwan Province of China; and
- Apple does not create the music content.

This is an interesting example of innovation and business networking for creating personalized user value. *(Source: Prahalad, C.K. and Krishnan, M.S., 2008)*

C. Case Study 3: IXC

A pharmaceutical company developed a new class of drugs that showed great promise in vitro, but encountered difficulties delivering the molecules into the cells. IXC identified a nanotechnology company on the other side of the world working on industrial polymers. An IXC intermediary visited the company, signed their confidentiality agreement and validated the potential application to drug delivery. IXC intermediaries facilitated a conference call and a Materials Transfer Agreement ensued. The research was quickly commercialized. To quote the CEO of the pharma company, "It would be irresponsible to place a monetary value on this opportunity but it saved us a year of development." *(Source: www.ixc.com.au)*

D. Case Study 4: Advanced Nanotechnology Ltd.

A significant development took place in 2000 when Advanced Powder Technology, a spin-off company of University of Western Australia (UWA), formed a joint venture with Samsung Corning to ramp up MCPTM technology for commercial-level production. The new 50:50 joint venture, called Advanced Nanotechnology Ltd. (ANT), received an initial investment of A$6 million from Samsung Corning. In 2001, ANT was also able to obtain a A$2.8 million Industry Start Grant. By July 2004, ANT was able to scale the MCPTM technology to commercial production levels. A key feature of the agreement with Samsung Corning was that both Advanced Nano and Samsung Corning would co-own the IP on MCPTM, while independently developing and commercializing product applications for MCPTM nanopowders.

The international patents taken out are all co-owned with Samsung Corning. Both Samsung Corning and ANT jointly make decisions regarding patent filing and maintenance and share the costs involved. ANT appears to have favoured this approach since Samsung Corning's international reputation can send a strong signal to competitors that the patents will be strongly defended if a challenge arises. At present, Samsung Corning and ANT compete in different markets segments and furthermore, the IP shared is only with respect to process technology.

Both Samsung Corning and ANT have to separately develop their own product IP and protect them through their own end-use patents. ANT's policy is to hold certain key process design IP as trade secrets, rather than seek patents and risk imitation by competitors. Samsung Corning does not have access to these trade secrets. Given these considerations, ANT has a strong view that the benefits of having Samsung Corning as a partner to enforce its process patents far outweigh the risk of Samsung Corning becoming a potential competitor.

At present ANT has launched three branded products, namely:

- ZinClear, a transparent SPF 30+ sunscreen containing zinc oxide as the only ultraviolet (UV) absorber;
- Alusion, a soft focus effect pigments for masking the effects of ageing;
- NanoZ, for long life transparent UV absorbing coatings; and
- A fourth product that is aimed for launch is a cerium oxide nanoparticle dispersion that is a key component in Envirox® (a diesel fuel additive that improves fuel efficiency and reduces carbon particulate emissions).

ANT sells its products in Australia, Europe, North America and the Far East. Some of the new products under various stages of development are:

- Iron oxide nanopowders (for UV absorber, cosmetics and industrial coating markets);
- Ceramic nanopowders;
- Nanosized drug particles for improved drug delivery; and
- Cosmaceuticals (products for appearance improvement through skin maintenance and repair).

In January 2005, ANT offered 45 million shares for subscription at an issue price of A$0.20 per share in order to raise A$9 million. Upon listing on the Australian Stock Exchange, ANT reportedly had a market capitalization of A$33 million.

This example is a good demonstration of the fact that in an open innovation setting when a small entity, such as a university, has 'valuable technology' it can deal with a global giant on equal terms. The example also shows the sophisticated understanding by UWA and ANT of the need to cleverly manage and protect the IP owned through appropriate partnering arrangements that reduce risk but entails sharing of benefits. It appears that the partners were able to forge trust and understanding based on the acceptance of the need to craft a "win-win" strategy. *(Source: Ramanathan, K., 2005)*

IV CONCLUDING REMARKS

- Firms and R&D institutions, especially those engaged in hi-tech development, have to change their traditional way of working and embrace new ways to succeed in today's global setting.
- Paradigms such as open innovation have great merit and should be seriously considered.
- In the context of innovation in HTCs (the theme of this workshop), while policies and government support will undoubtedly play a critical role, it is also important for the researchers and the managers of entities within the cluster to embrace an open innovation or collaborative innovation mindset.

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BACKGROUND PAPER (II)

SALIENT FEATURES OF NATIONAL INNOVATION SYSTEMS (NIS) AND PROMOTION OF NIS IN THE ASIA-PACIFIC REGION

BY

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I. NATIONAL INNOVATION SYSTEM

The concept of National Innovation System (NIS) has emerged due to 'globalization' of the economy, technology as well as the society, mainly facilitated and catalyzed by the latest innovations in information and communication technologies. This inturn has increased competition, internationalized manufacturing and introduced trade between specialized companies. It has also brought 'innovation' to the fore. Innovation from the context of NIS, means creation of knowledge or combination of existing knowledge using new methods to create new products and processes. The term "National Innovation System" was used by Mr. Christopher Freeman in his book on "Innovation in Japan", 1987, to describe the performance of the economically most successful country of the post-World War II period, namely Japan. The major characteristics of an NIS are:

1. Innovation and learning – Though there are a number of definitions to innovation, they would essentially mean or aimed at transformation of ideas into products or processes. It is also important to know that only a very few ideas ultimately reach the market depending on the innovation ecosystem. Learning from failure and social and economic tolerance to failure are key requisites of any NIS. Thus, 'innovation' and 'learning' are the most important norms in dealing with the technology innovation system.
2. Holistic and Interdisciplinary – All factors that determine innovation should be considered in dealing with NIS. Economic factors as well as international, organizational, political, cultural and social factors should be considered to have a comprehensive understanding of NIS. Operations and governance of NIS is interdisciplinary in terms of technology convergence and inter-ministrieal administration. The holisic and interdisplinary approach during the development and governance of NIS would determine the degree of success of any NIS.
3. Historical background – Different countries have their own historical backgrounds that would have shaped its own national characteristics that could be seen in the nature and behaviour of its people, society and culture. This would have an indirect bearing on the innovation capability, nature of innovation, development and governance of NIS. It is also important to note that modern technologies have become un-intended influencing factor in shaping the people, society and culture. And this has become a contentious issue.
4. Differences between NISs – NIS is unique for each country because the manufacturing system, investment in R&D, technology development and diffusion differ from one country to another. The factors of NIS are also different; hence, there isn't an optimal NIS. One can only compare which NIS is better and more effective when compared to others.
5. Interaction between elements of NIS – Innovation is understood as a process of combination of new and existing knowledge. Hence, interaction is important because innovative knowledge comes from various actors and institutions. The level of coordination between the various actors and institutions involved in the NIS will, to a large extent, determine the efficiency of the innovation system. In traditional economic theory, the term 'innovation' was understood mainly as process innovation: in effect, it meant introduction of new technologies to increase production and, at the same time, reduce cost per production unit. The innovation system pays more attention to manufacturing innovation in accordance with new demands. It involves organizational innovation as well.

II. GLOBALIZATION

Mr. Freeman also mentioned the concept of globalization. In the 1980s, internalization was the term used in market, finance, competition and company strategies as an economic perspective. Nowadays, globalization is the term of a globalized society resulting from deregulation and ICT development as a globalized society perspective. The characteristics of globalization are as follows:

- Increased competition – a company competes with national companies as well as MNCs in the home market;
- Technology globalization – Ideas and manufacturing resources come from different places (capital, labour, technologies and raw materials). Products and services are offered at global, regional and national markets tailoring to the market needs; and
- Increased trade between specialized companies.

In a globalized economy, big companies and MNCs have a greater role, especially in the hi-tech sector. They are able to grow in the technological environment of the nation as well as create a technological environment in the nation they belong to. In the process of globalization, it is very important to focus on science and technology (S&T) policy by supporting S&T infrastructure. S&T education – especially higher educational institutions, functions of technology production and diffusion and development of strategic technologies – needs to be supported by the policy.

III. GOVERNMENT POLICY SETTINGS

With globalization, government policy settings often stand in direct opposition. A government that seek to evolve, nurture and promote NIS has to (a) seek wide consultation within and across the government ministries, NIS key actors (industries, academia and R&D institutions) and technology transfer intermediaries, (b) choose opportunities and options today for tomorrow, (c) involve major stakeholders to share a common understanding, (d) Analysis of strategic S&T, (e) assess internal capacity and capability, and (f) identify economic and social demands and opportunities,.

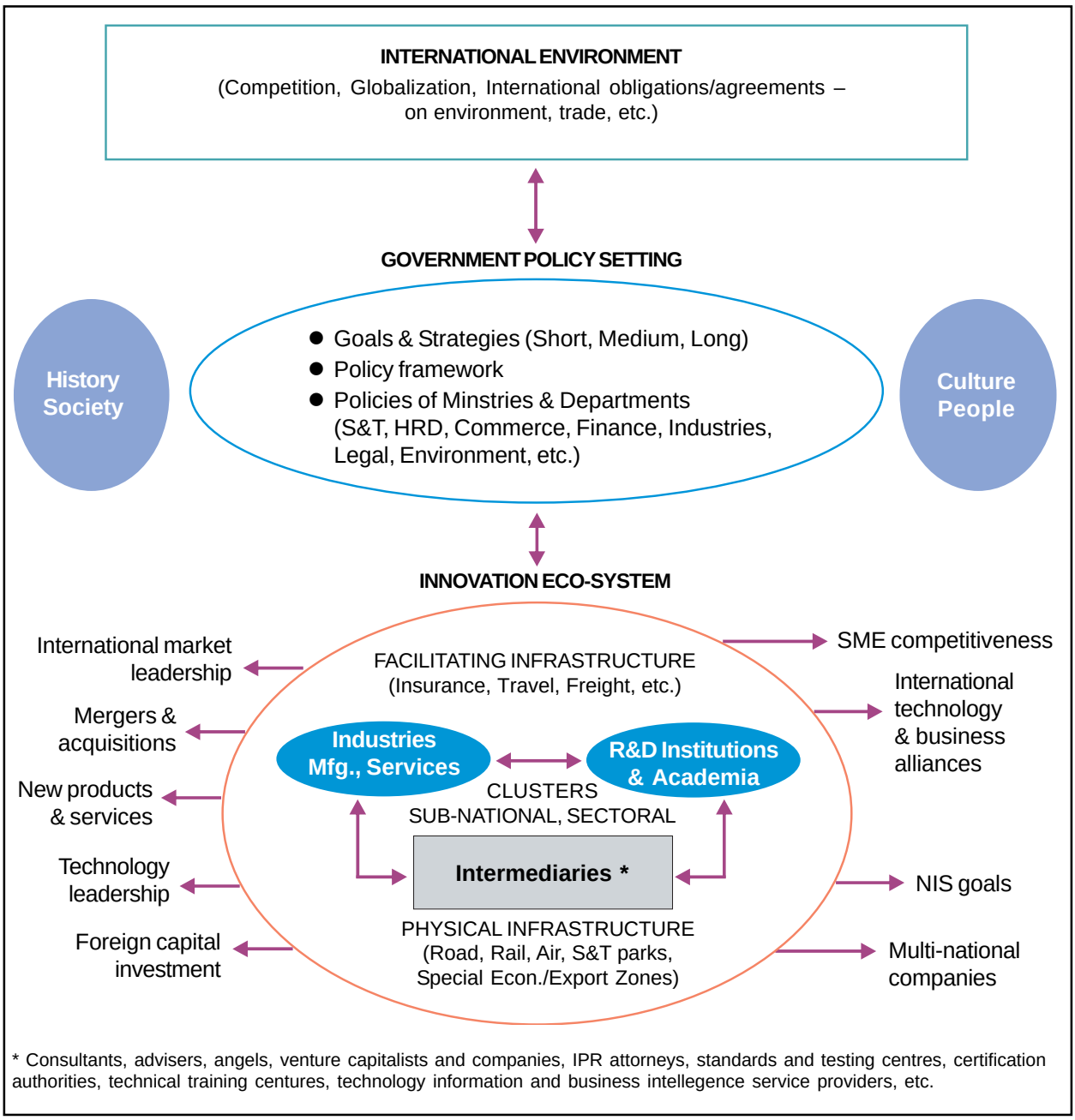
While developing the policy framework, the government would have to address the inherent tensions between the S&T-push and the demand-pull approach, between the stakeholders to the policy and the third parties' advocates, and between top-down and bottom-up decision making.

The policy settings has to be periodically measured in quantifiable outputs and outcomes, reviewed and re-engineered to meet the overall goat of the NIS. This may also require governments to recast existing institutions to strengthen their ability and capacity to deliver the outputs as assigned to them in the overall NIS goals and as set out by the institutions themselves.

The success factors of NIS depend on willingness and intention of the top decision maker, organizational culture and milieu, and avoidance of "not invented here" syndrome.

Major elements of an NIS framework that are common to many Asia-Pacific countries are:

Figure 2.2: National Innovation System (NIS)



1. Promotion of national strategic R&D – There are three different definitions of the term 'strategic'. The first derives from military strategy, the second from strategic trade theory and the third from the production chain. A common notion of threat is that a foreign country or firm could withhold the supply of equipment or know-how and thereby cause considerable economic damage. This is the main reason for almost every country that operates national R&D programmes and projects. However, with internationalization of technology, industries/governments have to position themselves in the global technology and value chain to access international markets and strengthen technological capabilities.

2. Human resource development – Technologies are normally embodied in people and institutions, and technologies come from scientists. Human resource development in S&T is a very fundamental resource in any NIS. Human resource development is known to be the most cost-effective investment in a company and in a country.

3. Creation of linkages between government-supported research institutions, academia and industry – Technological advance proceeds through the interaction of key actors, such as government agencies, universities, industries R&D institutions and S&T promoting agencies. They provide new opportunities for businesses to compete based on exploiting knowledge, skills and creativities to produce more valuable goods and services. Dynamic linkages between government-supported research institutions, academia and industry increase knowledge flow and this will transform new ideas and knowledge into businesses and strengthen the national innovation capabilities.

4. Commercialization of R&D results – New technologies and know-how that have been produced by the R&D institutes should be utilized by the start-ups or industry to produce new products and services in a competitive manner. This would occur only under specific government policy settings with funding and market access mechanisms for innovators and technology developers. This is an area of importance to Asia-Pacific countries to learn from experiences of each other.

5. Promotion of venture business – The government should promote setting up of venture businesses by providing technological and financial support and simplifying the start-up procedures. The role of private venture capital is important in augmenting venture business.

6. Establishment of business parks and business clusters – Physical and virtual agglomeration of innovators and start-ups to nurture their innovation is a major element of NIS in harnessing innovation. These parks and clusters are aimed to provide shared facilities and services for a certain period, and once matured the start-ups would move out to the market during its growth period. Performance of parks and clusters would depend on their ability to draw and nurture innovators and start-ups.

7. S&T awareness – Awareness on S&T should be created at all levels to gain public support for innovation policies and encourage competent students to take up science subjects in universities.

8. Promotion of women entrepreneurship – Women constitute a significant part of workforce, especially in the field of S&T. However, many women in both developing and developed countries still have various constraints, such as motherhood and family responsibilities, in developing a career in the area of S&T. Developing and maximizing the capabilities of women would benefit national scientific progress and national economics.

9. Introduction of sound S&T infrastructure – This is essential not only to develop high quality human resources but also to retain the talented human resources within the country as well as draw from outside.

10. Introduction of a new institution and/or reformation of existing institutions – Only in a few countries performance of institutions are professionally and periodically reviewed and restructured to meet the short, medium and long-term NIS goals. Republic of Korea is a very good example as one could see the result from the emergence of several multinational companies in a short period. Many countries

face political, economic and social limitations and challenges in restructuring the institutions. However, this is an essential element of NIS as well as to meet the national developmental goals.

IV. INNOVATION ECO-SYSTEM

The government policy settings that addresses issues and strengthen major elements of the NIS framework would result in the development of a robust innovation eco-system. In such an eco-system, the NIS key-actors – industries, R&D institutions, academia and intermediaries dynamically cooperate and collaborate in creating knowledge and transformation of innovation to commercial processes and products. The intermediaries would include consultants, venture capitalists, IPR attorneys, standards and testing centres, technology information and business intelligence service providers. The physical and facilitating infrastructure would play a major role in the successful outcome from the ecosystem.

There are direct and indirect ways of measuring the outcomes from the NIS/innovation ecosystem. Some of these are – enhanced competitiveness of SMEs, national and international technology and business alliances, foreign capital investments, mergers and acquisitions, international market leadership, etc.

V. PROMOTION OF NIS IN THE ASIA-PACIFIC REGION

Small and medium size enterprises (SMEs) of the Asia-Pacific region, in their quest to participate in and benefit from the process of globalization, face challenges mainly due to intense competition, shrinking life-span of products and access to new and emerging technologies. However, competitive enterprises see opportunities in the expanding global market and to collaborate with others for their mutual benefit. Competitiveness of an enterprise, whether in the manufacturing or service sector, mainly depends on its ability to harness and apply knowledge in its various activities. There are various institutions, including the enterprise itself, involved in the production, diffusion and application of knowledge. Competition and knowledge are the prime drivers of innovation – transformation of ideas into products or services. A country focusing on innovation has to evolve a systemic approach to promote and benefit from innovation. Development and management of such a systemic approach in a country, called National Innovation systems (NIS) rests with the Government, a key actor of any NIS.

A. Phase I (2005-2007)

APCTT formulated and implemented a project aimed at policy-makers and key actors of the National Innovation Systems (NIS) to enhance awareness of the concept and relevance of NIS, and enable them to develop policy frameworks and systems. It provided an opportunity to review existing policies and programmes from the context of NIS, and re-engineer/refocus them towards innovation, tailored to the needs of individual member countries. The project also identified challenges to be addressed in developing and practicing innovation systems. This project was funded by the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India. As planned, an Asia-Pacific Forum on NIS for High-Level Policy Makers and nine

national workshops were held in eight countries: China, India, Indonesia, Islamic Republic of Iran, Pakistan, the Philippines, Sri Lanka and Thailand. They drew participation of nearly 1200 NIS key actors from these countries. At the National Workshops, participants developed a set of recommendations, including appropriate policy mechanisms and support systems, relevant to the host country for promoting innovation and synergizing the knowledge, resources and overlapping mutual interest of industry, academia and R&D organizations.

An internet desk study entitled "NIS in India – a case study" was carried out as a pilot-cum-demo version for other target countries to carry out similar studies. The desk study contains web-resources on existing national policies and support systems of the Government of India. Other relevant information for the NIS Resouce Centre was also collated and compiled. The recommendations and presentations made by resource speakers and national experts constitute a major component of the web-based NIS Resource Centre.

The common recommendations from NIS workshops were:

- To evolve and formulate after due consultation and inter-ministerial coordination, an NIS policy framework with clear vision, strategies and priorities;
- To adopt a top-down or bottom-up or a combination of the two approaches for the development and governance of NIS policy framework that includes clusters, as well as sectoral and sub-national innovation systems (SISs) to exploit various competitive advantages of the country as a whole;
- To create and strengthen relevant infrastructure, institutional and support mechanisms, enhancing interaction and cooperation among different NIS key actors (government, industry and academia);
- To establish an appropriate framework to foster entrepreneurial and innovative activity with emphasis on venture capital mechanisms, technology and incubator parks; fiscal incentives to commercialize R&D outputs; and technology transfer liaison offices within NIS key actors;
- To develop and promote a new educational system that fosters at various levels (SMEs, public and private sector, engineering and technical institutes) technology-based innovation and entrepreneurship with emphasis on R&D and innovation management, technology transfer, industry-university collaboration, new venture start-ups and IP rights; and;
- To facilitate and promote NIS key actors to build political and social capital, strongly committed to innovation and research based on entrepreneurial culture, trust, cooperation, interaction and learning.

B. Phase II (2010-2013)

The Phase II project would continue to promote the concept of NIS and its organic linkages with the sub-national and sectoral innovation systems by building on the accomplishments of Phase 1. It will target Least Developed Countries (LDCs) and other selected participating countries that were not covered under the first phase. Expert meetings and national workshops will be organized to address the generic issues of evolving and administering of effective linkages among NIS key actors and country-specific NIS components. The approach of benchmarking and sharing of best practices of policy measures, support mechanisms and services would be introduced

and promoted at the workshops and meetings. The project would also address the gender dimension of NIS by promoting the discussion of how NIS would affect differently men and women entrepreneurship.

Major planned activities of the project are:

1. Meeting of least developed countries to delineate documented best practices in NIS;
2. Asia-Pacific Forum on NIS for high-level policy makers;
3. National workshops on NIS, sub-national and sectoral innovation systems;
4. National workshops on key components of NIS;
5. Training programme on development and management of national web-based NIS resource centre;
6. Dissemination of information on innovations in selected industrial/application areas; and
7. Enrich contents of the Asia-Pacific on-line resource centre.

BACKGROUND PAPER (III)

HTC IN NIS: MACRO FACTORS FOR CONSIDERATION TO DEVELOP A NATIONAL POLICY FRAMEWORK

BY

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I. INTRODUCTION

Generally, cluster means the territorial density of companies and their business partners of a given industry/business area together with related institutions. Smaller companies form a number of business networks. In all cases, they have close cooperation with local institutions, because the companies have realized that they can save substantial costs through such cooperation. Furthermore, global companies have emerged creating powerful competition. Within the majority of global industries/businesses, a powerful territorial concentration can be observed not only in the developed countries, but also in specific regions of these countries. There is a global-local paradox: the one that can compete at the global level is the one that utilizes local advantages.

The term 'cluster' is a collective concept that tries to sum up all the different forms of territorial concentration. Clusters can be formed in such business sectors where companies manufacture mainly for export (trade). This cooperation provides an advantage to all partners.

Clusters are built on the key companies of the region's leading industries. The key companies rely on their local business partners, suppliers and their networks while the whole industry relies on the local business infrastructure.

A regional cluster is essentially a local traction sector. The leading industry could consist of some large companies and their network of suppliers, but could even be the aggregation of several hundred small and medium enterprises (SMEs). Unlike networks, clusters usually do not have a formal membership.

The domestic base of stability of the local economy lies in the sector, the parties that make the preparations and the decision makers who reside there. All key divisions can be found there, decisions are made there, leading products are manufactured there and thus, development is also made there.

A cluster is nothing but the aggregation of individual companies of a given industry together with the economic sectors and institutions connected to them; parties that use each other's products and services on a relatively high scale rely on the same knowledge base and infrastructure, and can utilize similar innovations.

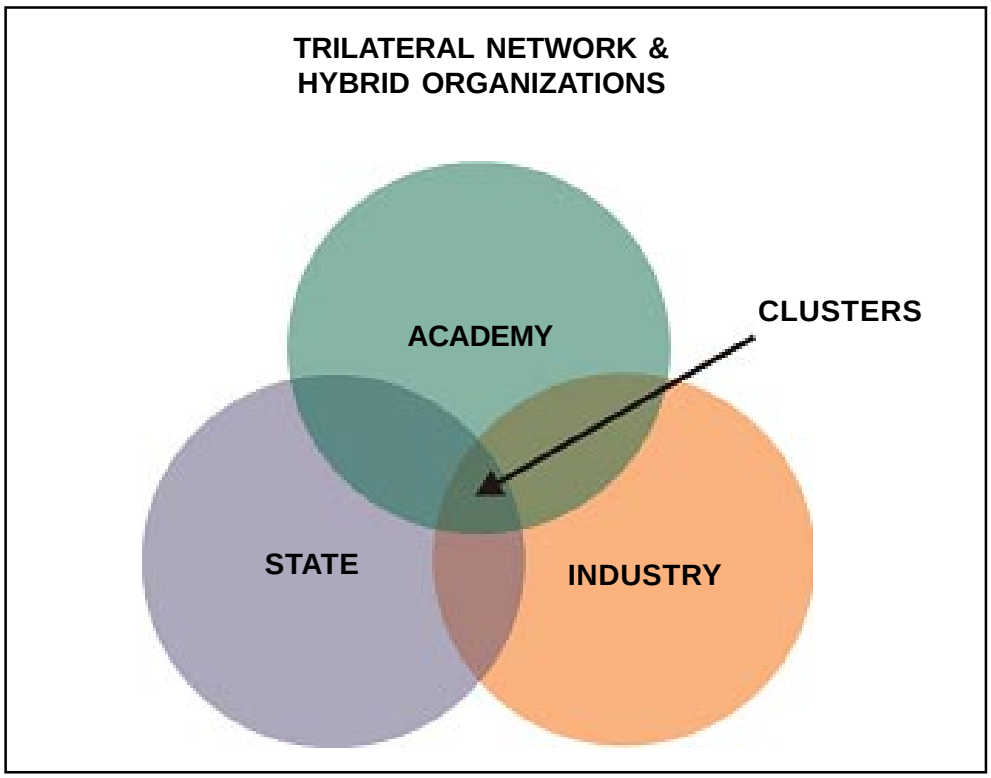
Companies have realized that they can only survive in global competition by relying on local background and business partners, who could improve their profitability and ability for adaptation.

Some principles of cluster development are listed below:

- Recommended (practical):
  - To motivate the development of clusters;
  - To use the cluster as a demonstration model and to encourage the companies to form new cooperations;
  - To strive towards the expansion of the cluster; and
  - To assess the global market of the regional industries and to support large companies and development agencies for the stimulation of clusters.

- Not recommended (non-practical):
  - To artificially create a cluster;
  - To advertise the cluster as end goal;
  - To engage in the survival of certain clusters or companies and to create only one cluster for a longer time;
  - To provide unfocused support;
  - To encourage innovation when the goal is modernization; and
  - To force competition of development agencies.

Figure 2.3: Triple Helix Model



The Triple Helix model consists of three spheres: it creates a complex innovative theory through the three-fold connection of university-scientific community, economic sphere and the governmental services. Its main statement is that the continuous communication among these three sectors secures their own improvement, and that such a condition is necessary for the formation of knowledge-creating regions (Etzkowitz-Leydesdorff, 2000).

The model explains that the goals of each sector are determined by different aspects, that their roles get changed in the knowledge-based economy and society, and that their scope of duties can broaden or narrow down. The most typical, and very important, statement of this model is that it is necessary for these three sectors to extend into each other, so their activities and their organizational boundaries overlap. Their dependency on each other obviously occurred due to the global competition, as this is the answer of the highly developed regions to powerful competition.

II. INNOVATION SYSTEM

Many factors influence the innovation processes. Innovation occurs in interaction between institutional and organizational elements. They are together called the "system of innovation".

The innovation system has three scales:

1. National Innovation System (NIS);
2. Regional Innovation System (RIS); and
3. Sectoral Innovation System (SIS).

A. National Innovation System

"The National Innovation System is the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technology" (Freeman, 1987). Innovation processes are related with multiple actors: university, public research and development (R&D) institutes, industry, community, financial institutes and consulting firms.

The parts of NIS (Inzelt, 1998) are:

- Every level of education;
- Research, formal R&D system;
- Process of technique dissemination;
- Relationship between universities and companies;
- Relevant institutions from innovation point of view;
- Relevant parts of the law system (IP, competition law, customer protection, etc.);
- Process of learning (in manufacturing and service);
- Relevant profession politics;
- Appropriate parts of the financial system; and
- Professional organizations, associations.

The characteristics of NIS is that the quality of its components are dominant regarding the enterprise as the possibilities for utilization of the technology are beyond the enterprise's absorption ability determined by the forms of channels for supporting the technology flow and their effectiveness. Inside NIS, technology and knowledge are distributed and change hands through the following channels:

- Invested techniques and purchased technical equipment;
- Employed personnel;
- Patents and licences;
- Scientific publications; and
- Hidden informal networks.

In an NIS, leverage points exist for enhancing innovative performance and overall competitiveness. These can help identify the mismatches in the system and among institutions, and identify the government policies that threaten innovation and technology

development. Every country differs in the way in which knowledge flows are structured. They also differ in the relative importance of various types of institutions, actors and linkages for their respective production system. In some countries, institutional interactions are easier than in others.

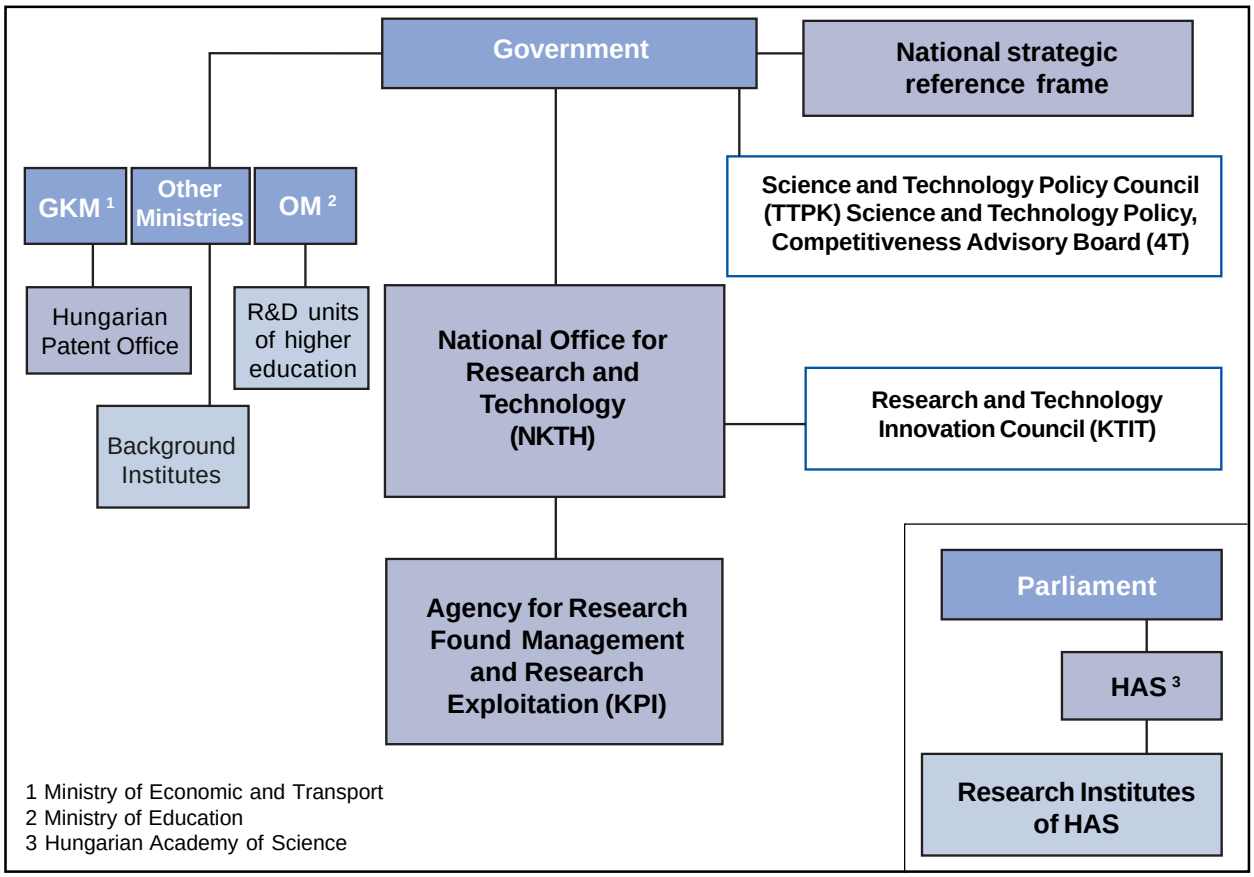
The main characteristic of a high-tech cluster (HTC) is that it has direct access to basic research and to public research institutes and universities, complementing its own research activities. HTCs are very R&D-intensive and tend to exhibit close collaboration with the public research sector.

Innovation processes are non-linear or networked interaction with scientific and technological knowledge, R&D, money, people and business development. Each innovation actor has a specific role in the system. In an innovation system, new innovative clusters can emerge and these clusters are more than the sum of individual parts.

The study of NISs focuses on flows of knowledge. Analysis is directed to improving performance in knowledge-based economies, which are directly based on the production, distribution and use of knowledge and information (OECD, 1996b).

The main actors in an NIS are: government, industry, university, financial institutions and consulting firms. The input is money, people and knowledge, whereas the output is scientific and technological knowledge that enhances competitiveness.

Figure 2.4: NIS in Hungary



B. Regional Innovation System

"The Regional Innovation System is a geographically concentrated network of different actors that permanently co-operate, whose interaction is essential for their innovation activities." (National Workshop on Sub-national Innovation Systems and Technology Capacity Building Policies to Enhance Competitiveness of SMEs, 2006)

Sub-national or Regional Innovation System (RIS) is a small NIS. It has characteristics that are common to NIS and it is influenced by national policy. It could be locally or regionally based. The effectiveness of RIS depends on local conditions and it is influenced by local policy. Clusters are a key factor in RIS and they play an important role by employing people and otherwise creating new value. The most obvious reason for the importance of clusters is that throughout their geographic proximity they tend to facilitate the key points made in the systematic approach, namely learning through interaction. It is common that a firm in a cluster enjoys all advantages in terms of innovation performance through processes of localized learning. A RIS can cross over several sectors in the regional economy. Thus, clusters and RIS may co-exist in the same territory and an RIS may contain several clusters. However, a cluster is not an evident part of an RIS.

C. Sectoral Innovation System

According to the definition, a sector is "a set of activities that are related by a set of product groups for a given emerging demand and share some basic knowledge." The major components of a sector are knowledge and technology, actors and networks, and institutions and demand. In a Sectoral Innovation System (SIS), actors range from individual level to a collection of organizations. The organizations include both firm (suppliers, producers and customers) and non-firm organizations (universities, financial institutions, government agencies, trade unions and technical associations). These actors are connected with each other, and interact through different kinds of linkages (Malerba, 2004).

III. MACRO FACTORS AS DETERMINANTS

Macro factors look at the external business environment and they offer an appropriate strategic tool for understanding the external environment. Macro-environmental analysis – the study of political, economic, social and technological factors – is a helping tool for the analysis of an institution's political, economic, social and technological environments. Newest trends, sector-specific tendencies and company case studies of direct foreign investments are analysed using macro factors as determinants (policy, economy, society and technology) broadened with global contexts.

The wide environment reflects border conditions for the company to which – liked or not – it has to adapt. This level of the environment covers not just a given company and its industrial environment, but also a number of inter-connected industries related to the company.

Such an analysis means the systematic quest for the long-term tendencies that affect a given organization. The effects of these tendencies could be then qualified, according

to which one of them could have favourable effects that ease the company's activities (by broadening its market possibilities), or one of them could have unfavourable effects that narrow down the company's markets (by increasing the number and strength of potential competitors).

The macro factor analysis studies a company's environment independently using the following four dimensions:

- Political elements – Stability, laws, regulations, policies and integration. Political factors are:
  - Tax policy;
  - Regulation on competition;
  - Employment laws;
  - Environmental laws; and
  - Government stability.
- Economic elements – Trends of gross national product (GNP), gross domestic product (GDP), employment/unemployment, inflation, balance of payment of the country, change of the expendable income of families and change of energy and other prices. Economic factors are:
  - Business cycles;
  - Trends of business growth;
  - Interest rates;
  - Inflation; and
  - Unemployment.
- Social elements: Demographic processes spread of income, social mobility, level of education, lifestyle in the different social groups. Socio-cultural factors are:
  - Demographic parameters;
  - Spread of income;
  - Social mobility;
  - Lifestyle;
  - Relation to work; and
  - Quality of education.
- Technological elements: Research programmes (rate of R&D expenditure, technological development policy), speed of technological change, rate of computerization, level of basic infrastructure. Technological factors are:
  - Level of research expenditures;
  - New discoveries;
  - Governmental technological goals; and
  - Speed of technology transfer.

IV. CLUSTER POLICY

Based on surveys in the European Union and elsewhere, the principles of cluster-based economy development policies can be given as follows:

1. While individual companies or their well-bordered groups (closed networks) are not supported, local/regional systems of enterprises are supported;
2. The focus is not exclusively on the attraction of external (global) investments, but the interest is on the local agglomeration of SMEs and on the endogenous growth processes;
3. The "winners are supported" – the successful local industries/business sectors get support by the strengthening of "bottom-up" processes generated by the local governments and leading organizations of the industry;
4. Priority is for the motivation of social processes (e.g. trust-based mutually beneficial cooperation, the dissemination of knowledge among local parties, etc.) and against financial supports that are often only effective on short term);
5. The formation of clusters points out the importance of public figures that can foster cooperation; and
6. The role of the developing agencies (brokers) is significant in case of connections among companies, as well as between companies and knowledge generating/ relaying institutions.

Overall, there is a need for decentralized public administration, bottom-up strategies in demand-oriented regions and local territories, and a self-organization of economic and local institutional parties (operation of regional economy development networks).

Based on the conclusions of the European survey, it can be stated that the goals of the cluster-supporting policy in practice are:

- Invigoration of cooperation between companies and business networks;
- Strengthening of technology transfer organizations acting upon the needs of companies; and
- Based on the above, actual formation of RISs.

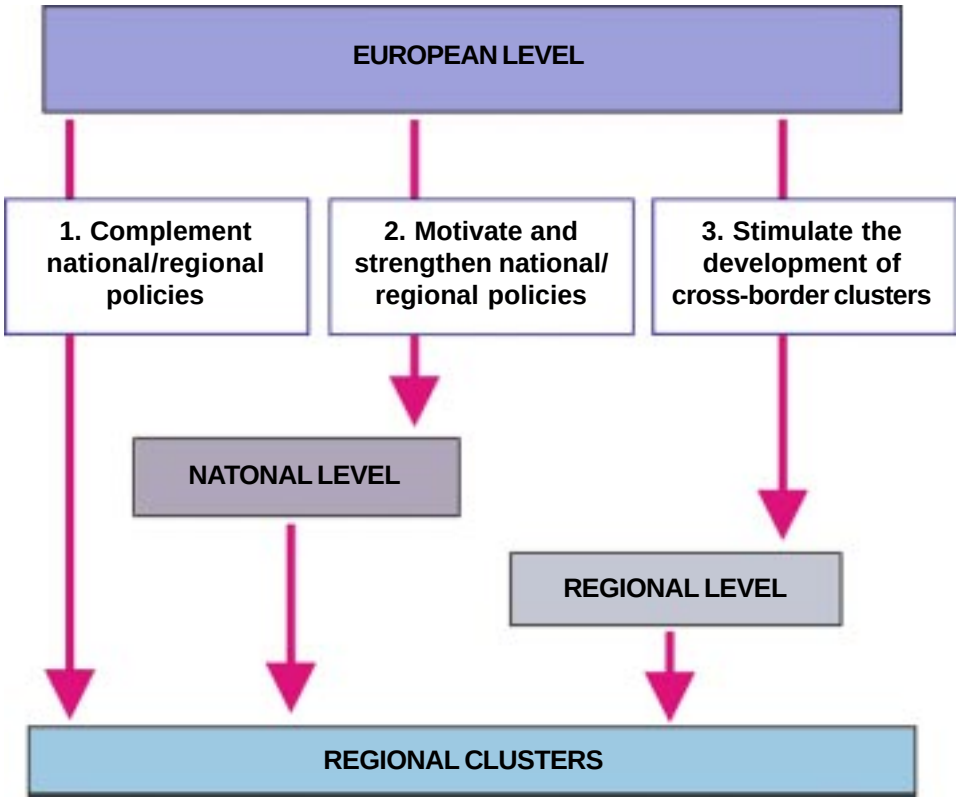
The aim of cluster policies is to support the creation of cluster initiatives. In cluster initiatives, there are organized efforts to increase the growth and the competitiveness of clusters within a region involving cluster firms, government and/or the research community.

There is a cluster policy mix in Europe that includes the national and regional policies. The objectives of this policy are:

(1) To complete regional and national cluster policies;
(2) To motivate and strengthen regional and national cluster policies;
(3) To support the creation of regional and national clusters by strengthening the knowledge base in Europe and enabling better exploration of research for innovation; and
(4) To stimulate in particular the development of cross-border clusters.

It is better to design the cluster policy at national and regional bloc (such as European Union) level, strengthening initiatives more efficiently and connecting clusters better through transnational cluster cooperation and exchange.

Figure 2.5: European mix of regional and national cluster policies



(Source: Innovation Clusters in Europe, European Communities, 2007)

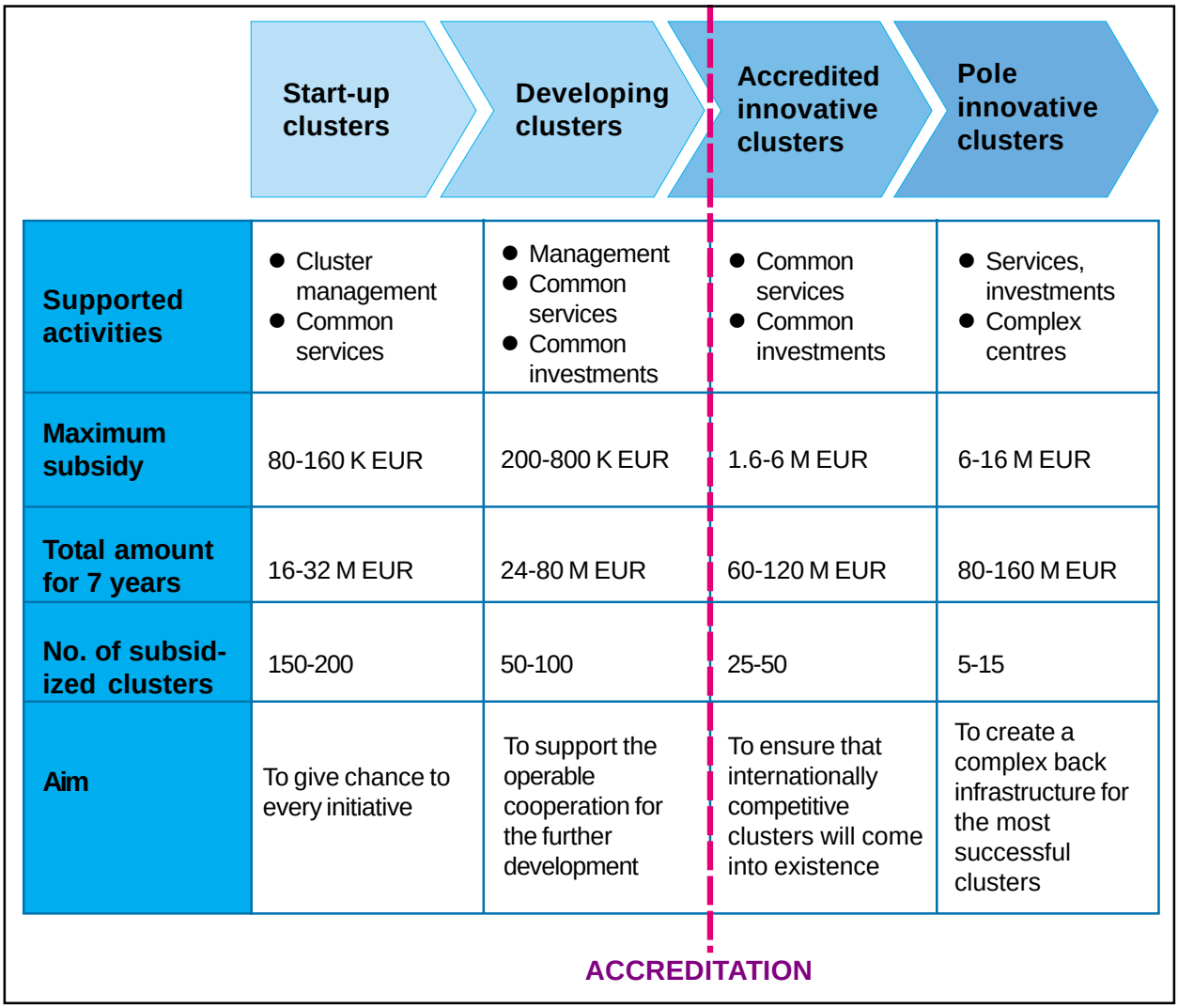
A. Cluster accreditation

In Hungary, the Pole Programme is the flagship programme accepted by the government. The goal of the programme is to increase international competitiveness through the support of serious, innovative and export-oriented clusters together with the support of investments for the development of entrepreneurial environments in the pole cities within the framework of the government's economic development concept.

The government expects from the Pole Programme that enterprises will reach the necessary size for European Union level competitiveness through cluster and network formation, and through cooperation with universities and researchers as well. The government thus expects the companies to significantly improve the overall competitiveness of the Hungarian economy through the strengthening of high value-added, export-oriented activities.

The drawing of fund resources that specifically support collective developments will only be available for such clusters that have passed the uniform consideration system (accreditation).

Figure 2.6: Domestic cluster development stages



The roles of accreditation are that firstly, it is a selection method using which the appropriate clusters/cooperations for the programme goals can be chosen. Secondly, it lowers the risks of the realization of the programme.

A common policy framework needs to:

- Enable cluster emergence;
- Support cluster initiatives; and
- Connect clusters through transnational cluster cooperation and exchange.

V. CONCLUSIONS AND RECOMMENDATIONS

There are some major questions to ascertain the strategy: Will the universities be able to produce scientific breakthroughs? Can the hi-tech sectors thrive in the midst of

significant political issues? When will patent harmonization be finally achieved? How will other countries react to life science developments? Can the Asia-Pacific region win its way to a leadership position in the world? Can the Asia-Pacific region become a leader in hi-tech areas?

The main tasks for developing HTC are:

(1) Encourage R&D activity;

(2) Step up bringing together of high-level R&D organizations;

(3) Set up an innovation service organization;

(4) Develop high-level technology service industries and establish innovation service support system;

(5) Attract social capital by setting up investment-oriented capital for business establishment, limited partnership investment experimental unit and new area technology industry fund; and

(6) Invite financial capital to take part in the transformation of the scientific and technological achievements.

BACKGROUND PAPER (IV)

NEW ISSUES IN HI-TECH CLUSTER ANALYSIS

BY

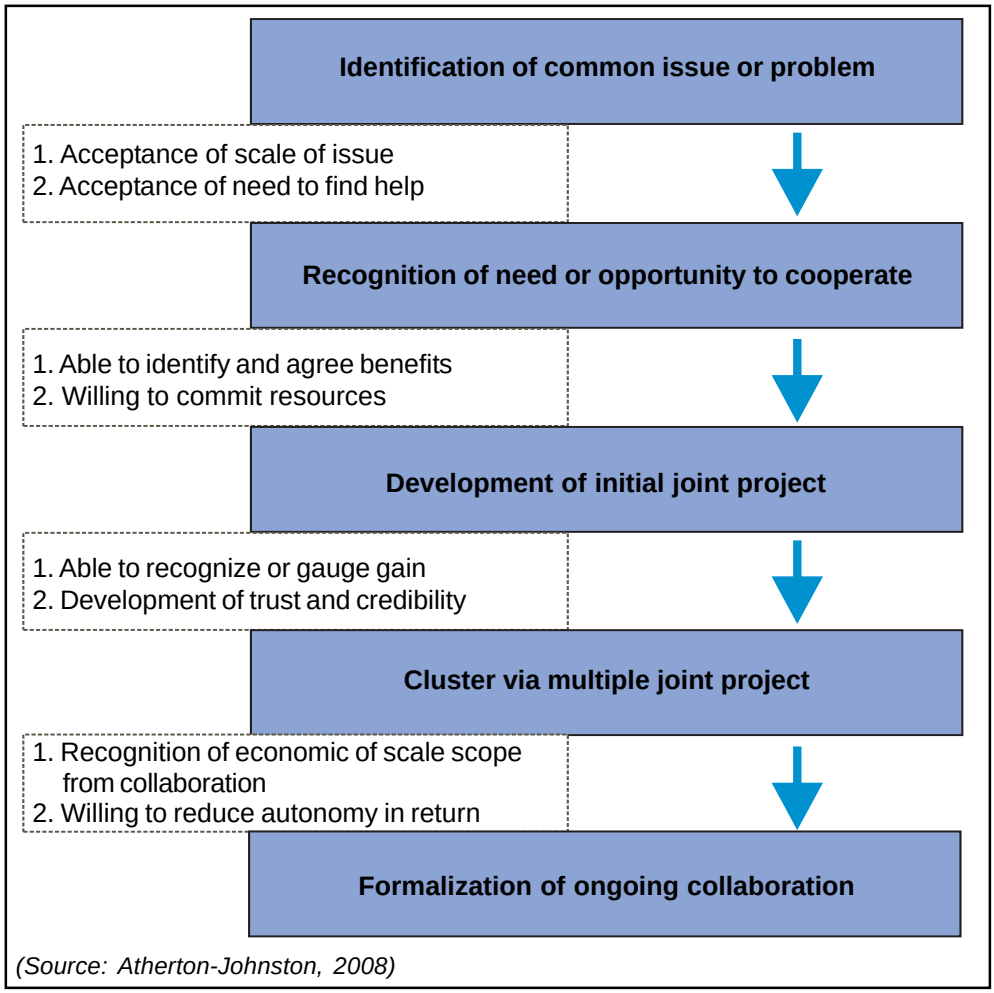
MR. PETER MORGYOROSI,
CONSULTANT, APCTT-ESCAP

I. CLUSTER FORMATION

The initiation of cluster begins when a group of firms moves from individualistic attempts to address business issues and explore market opportunities together with other firms in order to strengthen their resources and capabilities.

Five stages can be identified in the process of cluster formation. Cluster formation involves the development of greater levels of collaboration between firms and other institutes, and hence both provide wider economies of scope. Otherwise, they create higher levels of inter-firm dependency and reciprocal trading. Becoming a cluster can enhance individual firms as well as group competitiveness and loss of autonomy because of greater interdependence.

Figure 2.7: Cluster formation



(Source: Atherton-Johnston, 2008)

Stage I: Identification of a common issue or problem

This is the first step in the formation of a cluster. At this stage of development, businesses do not work together and in one-third of circumstances do not appreciate or recognize the potential of cooperation.

Stage 2: Recognition of a need or opportunity to cooperate

Many firms have similar issues and challenges in their development process but that is not enough for group collaboration. Clusters begin to form when the potential to work together transforms into active interaction and cooperation. The aim is to address shared concerns. In this phase, firms are pushed to collaborate with businesses. Clusters start to form when problems become significant enough to drive individual firms to seek out and make collaboration. Recognition of the need or the chance to collaborate moves firms closer to direct collaboration.

Stage 3: Development of an initial collaborative project

Firstly, a network of firms having a common issue accept and then agree that there is scope for collaboration. The following important step is to determine the form, scale and nature of cooperation. Typically, the projects are based on defined parameters and means of working together, and that provides limits to individual firm commitment to collaboration. The initial test project allows firms to learn more about the other partners with whom they are cooperating. This initial project helps firms in the collaboration to develop protocols and rules for cooperation. This pilot project can generate the mechanisms and trust for future cooperation.

Stage 4: Emergence of ongoing group collaboration through multiple projects

The next step in cluster formation is to initiate multiple projects. During the initial project, participants can see further benefits from this type of collaboration and thus explore further opportunities to develop new projects and group activities. Through ongoing collaboration, the firms participating in the projects are able to develop a higher level of trust and as a result become more mutually dependent. Thus, ongoing collaboration through multiple projects creates the conditions for greater levels of cooperation.

II. CLUSTER DEVELOPMENT

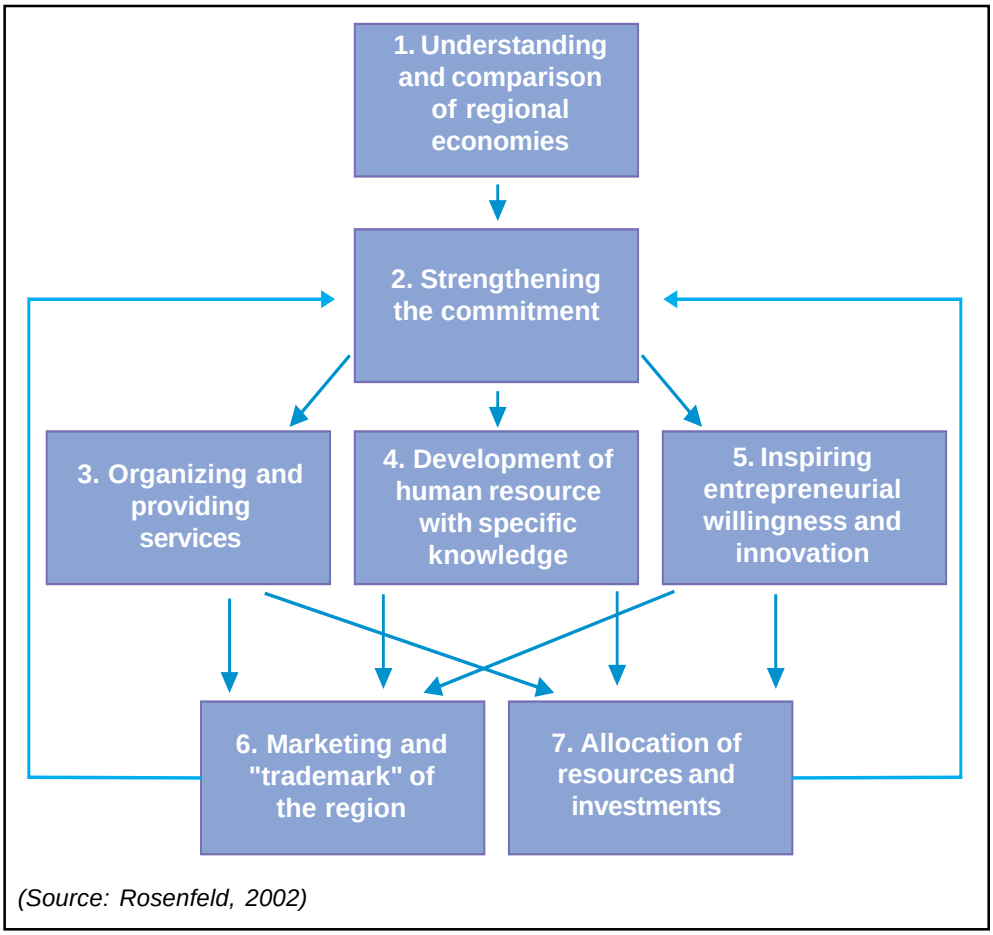
1. Understanding and comparison of regional economies

The development ideas are only effective if the involved parties are fully aware of the exact operation of a regional economy and the boundaries and opportunities a regional/ local government has.

2. Strengthening of commitment

Common representation is needed for the efficient appearance of the collective identity, and this can be built up by the regional cluster council. It is important that the cluster council have itself accepted as the central party of cluster development programmes.

Figure 2.8: The management of traded clusters within the bottom-up economy development of less advanced regions



(Source: Rosenfeld, 2002)

3. Organization and rendering of services

Organization of common services, which are by virtue of their economies of scale usually much cheaper than those individually organized by the entrepreneurs (e.g. training, education, financial consultancy, marketing, etc.). There should be a switch from solution-oriented view to problem-oriented view.

4. Creation of workforce base possessing specialized knowledge

Clusters have to cooperate with workforce training institutions because it is more favourable for companies than individually organizing trainings on their own.

5. Motivation of readiness for venturing and innovations

The driving force of the development of every cluster is the readiness for venturing together with the takeover and introduction of productivity improving initiatives. The

readiness for venturing changes is slower because it depends on the education system, cultural norms and the support policies.

6. Marketing and "trademark" of the region

If the local cluster is included in the marketing and image of the region, then the local politics will be more committed and connections can be maintained more easily. Perhaps the replacement of workforce would also be easier.

7. Allocation of resources and investments

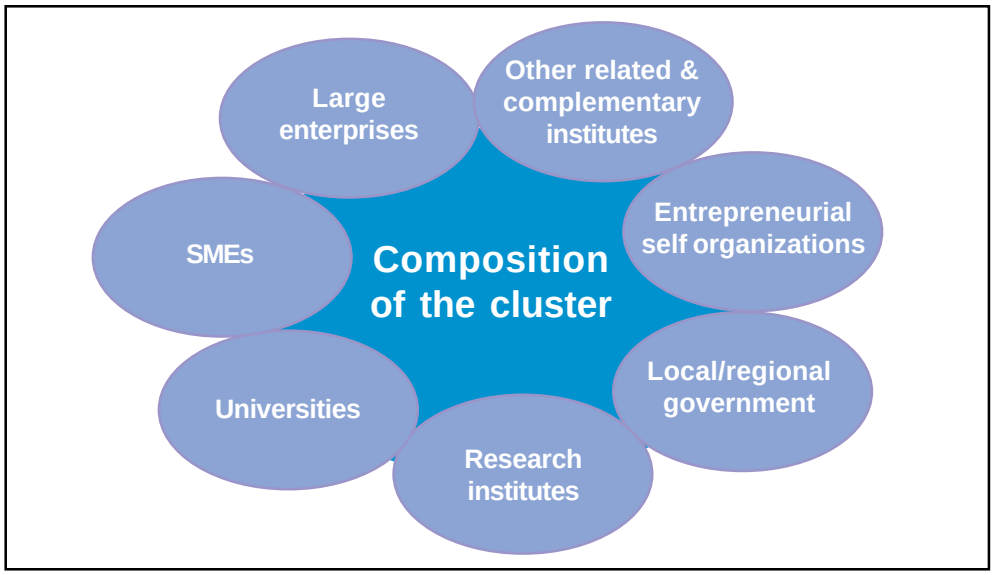
III. INDICATORS FOR ASSESSING THE PERFORMANCE OF HI-TECH CLUSTERS

A. Composition of the cluster

Every hi-tech cluster (HTC) has several components and each has a different role in the life of a cluster. Large enterprises have enough resources to build up a significant research infrastructure. On the other side, there are the small and medium enterprises (SMEs) that in the European Union hire 80 per cent of the employees; therefore, they have an important effect on the economy's performance. Universities train the workforce with the appropriate knowledge for the needs of companies. It is important that universities are able to cooperate in R&D projects (mainly in basic and applied research).

Research institutes' main role is that they have the appropriate knowledge base and infrastructure for R&D projects. The local or regional government has the opportunity to support the formation of clusters through support programmes, and is able to approve

Figure 2.9: Composition of the cluster

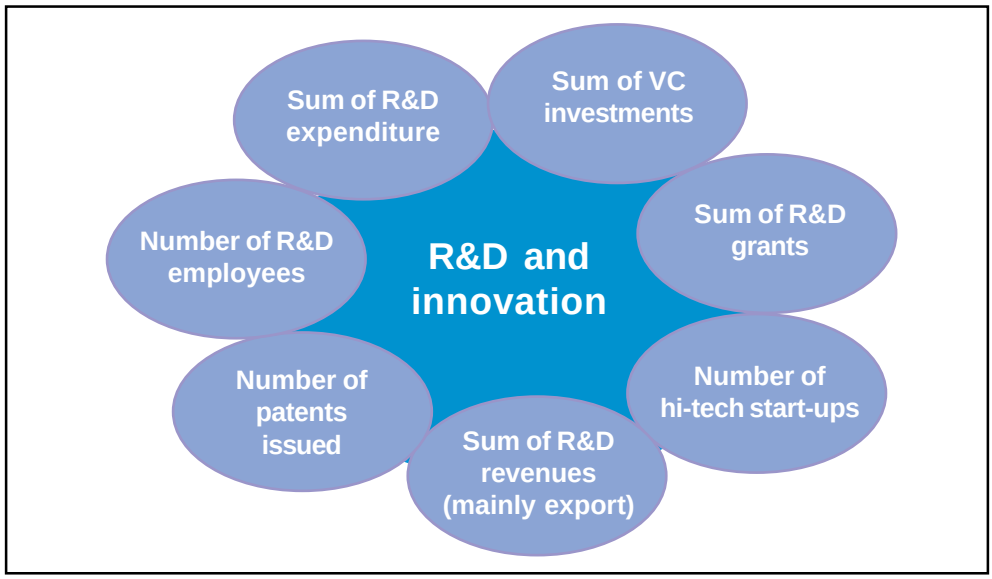


the proposals of the business sector and willing to support them. For entrepreneurial organizations, strategic cooperation initiates the formation and development of the cluster. There are, of course, several other related and complementary institutions such as financing institutions, consulting companies, suppliers, etc.

B. R&D and innovation

R&D and innovation are also main indicator factors. We can pose some questions as follows: What percentage of the total employees deal with R&D activity? How many patents are taken in a year? How many hi-tech start-ups are available in the region in that specific sector? Other factors are: the amount of R&D grants, which can come from the government, the bloc-level organization (such as European Union) or both; the amount of revenues (mainly from export) that come from the traditional activity and from the R&D activity; and the sum of venture capital (VC) investments, which is a type of private equity capital typically provided for early-stage, high-potential and high-growth companies in the interest of generating a return through an eventual realization event such as an initial public offering (IPO) or sale of the company.

Figure 2.10: R&D and innovation

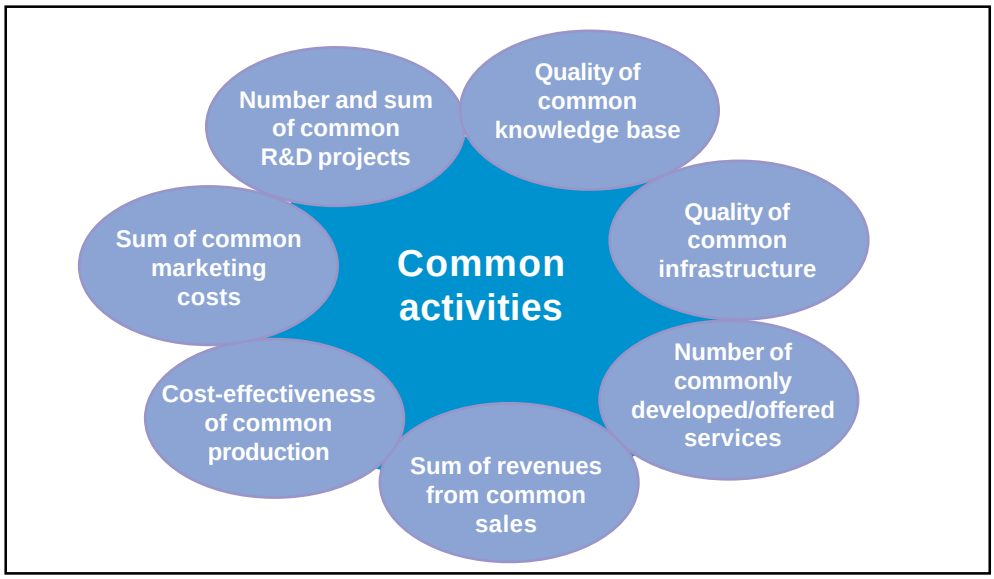


C. Common activities

Common activities also serve as an indicator. The number and cost of the commonly developed R&D project, the amount of common marketing costs and the amount of revenues from common sales also give us information. Further indicators are the cost-effectiveness of common production, the number of commonly developed and offered services developed by a group of cluster members and offered commonly by them, the quality of common infrastructure that is commonly used, specialized tangible and intangible assets for completing the needs of the R&D activity of the cluster, and finally, the quality of common knowledge base highlighted by the high role of educational organizations, common culture and knowledge sharing.

D. Value chain

Figure 2.11: Common activities



In the value chain, the first factor is the proximity of suppliers. There is a spatial and time proximity of suppliers who can complete the special needs of the companies and institutes performing R&D activities. A vertical link exists where companies perform on the same part of the value chain (e.g. all of them are material manufacturers). In the case of horizontal linking, companies link horizontally in the value chain (e.g. material producer and material processor). The whole verticum is when companies and institutes cover the whole value chain from material production through deploying the final product on the market to after-sale service. The part verticum means that the companies and institutes cover only a part of the value chain.

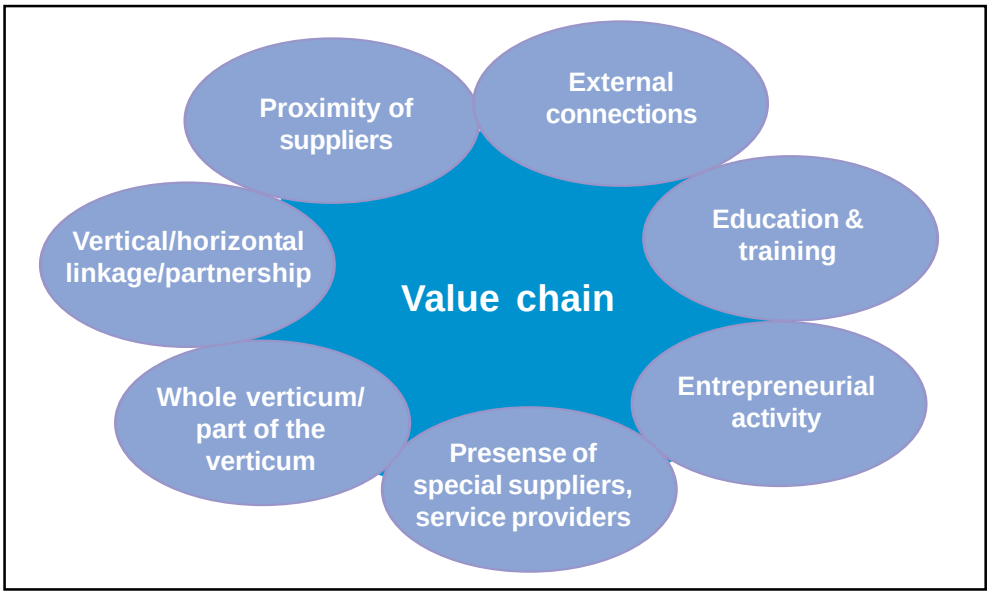
In the value chain, special suppliers and service providers are present and can complete the special needs of the cluster. The entrepreneurial activity (how long the entrepreneurial activity is in the region) and the education and training (life-long learning, practical skills) also have an important role in the value chain. However, the external connections with foreign companies, educational and research institutions and actors from other clusters also exist in the value chain.

IV. SELECTED CASE STUDIES ON PERFORMANCE ANALYSIS AND ASSESSMENT OF HTCS

A. Cluster analysis in the European Union – Methodology of the European Cluster Observatory

This cluster mapping was made by the European Cluster Observatory. The database is built in the intersection of regions and sectors in Europe. To determine the level of regional analysis, the Nomenclature of Territorial Units for Statistics (NUTS) classification

Figure 2.12: Value chain



is used. NUTS is a hierarchical classification that subdivides each member state into a whole number of regions at NUTS 1 level. Then each of these are subdivided into regions at NUTS 2 level and these in turn to NUTS 3 region. The internal administrative structure of the member states is generally based on two of these three main regional levels. The European Union defines 259 regions, mainly NUTS 2 regions.

The focus of this mapping was on geographically concentrated industries. According to Porter, we identify three types of industries with very different geographic profiles:

- Local industries: Their presence indicates that they serve local markets and are not exposed to direct competition across regions. Examples of such industries are local retail and other local service. In Europe, local industries account for almost 57 per cent of total employment.
- Traded cluster industries: They are geographically concentrated. In this type of industries they have the choice as to where to locate and serve markets across regions (e.g. financial service and automotive). Such industries account for almost 57 per cent of total employment.
- Natural resource-based industries: They are concentrated geographically, but they have to locate where the deposit of natural resource happens to be. They always serve global markets, but do not have much locational choice. They account for around 5 per cent of employment in Europe.

The project has used 38 cluster categories, such as information technology, biopharmaceuticals, education, knowledge creation, etc.

In the mapping to complement the data, two additional cluster performance indicators were used: innovation index and world export share.

The first indicator, the Regional Innovation System Index indicates the general innovation climate within a region, and this consists of seven innovation indicators:

1. Human resources in S&T – core (percentage of population);

2. Participation in life-long learning per 100 population (aged 25-64);
3. Public R&D expenditures (percentage of GDP);
4. Business R&D expenditures (percentage of GDP);
5. Employment in medium-high and high-tech manufacturing (percentage of total workforce);
6. Employment in hi-tech services (percentage of total workforce); and
7. European Patent Office (EPO) patents per million population.

The other indicator, the Export Data, represents the world's share of a country in exports of a given cluster category (2006 European Regional Innovation Scoreboard, MERIT, 2006).

B. Selected case studies

1. Biotechnology cluster in the United Kingdom

There are 10 critical factors in the generation of a successful biotechnology cluster in the United Kingdom:

1. Strong science base;
2. Entrepreneurial culture;
3. Growing company base;
4. Ability to attract key staff;
5. Availability of finance;
6. Premises and infrastructure;
7. Business support services and large companies in related industries;
8. Skilled workforce;
9. Effective networks; and
10. Supportive policy environment.

2. Clusters in Hungary

The Hungarian government has approved the Pole Programme as the flagship programme. The programme's goal is to improve international competitiveness by supporting innovative and export-oriented clusters, together with providing investment support for the development of entrepreneurial environment in the pole cities within the framework of the government's concept of economic development.

Goals of the Pole Programme are:

1. Fostering the creation of internationally competitive clusters;
2. Specialization in high value-added, innovative activities;
3. Strong cooperation primarily among companies, and complementarily between universities and municipalities, in order to maintain long-term competitiveness; and
4. Strengthening the role of regions through pole cities by supporting the improvement of poles' elementary competitiveness and business surroundings.

Table 2.1: Biotechnology cluster in the United Kingdom

Region	Key Strength	RDA	Key Multipliers	Centres of Excellence
Cambridge	• Fully established cluster • Technology development	ERBI	• East of England Development Agency	• Sanger Centre • Babraham Institute • John Innes Centre • Laboratory of Molecular Biology
London	• Finance capital • World conference centre • Medical research	• London Development Agency	• London Biotechnology Network	• London Bioscience Innovation Centre • Imperial College • Numerous medical schools, hospitals, institutes
Oxford	• Drug discovery • Diagnostic devices	• South East England Development Agency	• South Healthcare Technology Alliance	• Weatherall Institute of Molecular Medicine • Oxford Genetics Knowledge Park • Diamond Synchrotron • MRC Harwell
North West	• Biomanufacture • Bio- and health informatics • Clinical trials • Medical imaging	• North West Regional Development Agency	• BioNoW	• National Bio-Manufacturing Centre • UK Biobank Storage Facility • Wolfson Molecular Imaging Centre • Northwest Institute for BioHealth Informatics
South West	• Drug discovery • Vaccines • Diagnostics	• South West England RDA	• BioApproach SW	• Health Protection Agency • Defence Science and Technology Laboratory
North East	• Clinical research • Small & large scale process • Emerging technology	• North East RDA	• BioNET • North East Process • Industry Cluster	• Centre of Excellence for Life Sciences • Institute for Aging & Health • Life Knowledge Park
East Midlands	• Biomedical research • Newly created clusters	• East Midlands Development Agency	• BioCity (Nottingham)	• Institute of Pharmaceutical Sciences and Experimental Therapeutics • Interdisciplinary Biomedical Research Centre • Cancer Research Nottingham Centre
Scotland	• Scientific excellence • Financial services • Innovative business models	• Scottish Enterprise	• Nexxus • BioDundee • Edinburgh BioAlliances	• Translational Medicine Research Collaboration • Scottish Centre for Regenerative Medicine • Centre for Biomedical Research
Wales	• Clinical research • Medical technology • Diagnostics	• Welsh Assembly • Government	• Wales Trade International	• Wound Healing Research Unit • AberBioCentre • Centre for Applied Marine Sciences
Northern Ireland	• Cancer biotech • Medical devices	• Invest Northern Ireland	• Invest Northern Ireland	• Medical Polymers Research Institute • Centre for Functional Genomic and Molecular Biodiversity • RTD Centres of Excellence in Proteomics • Speciality Pharmaceuticals Centre • Centre of Excellence for R&D in Controlled Drug Delivery

(Source: www.biopartner.co.uk)

Table 2.2: Hungarian accreditation procedure

Common activities	Composition of the cluster	Economic performance of SMEs	R&D&I performance	Strategy of the cluster	Strategy of the cluster
Common marketing cost	Number of SMEs	Added value	R&D cost	Common aims	Growth of average wage per head
Projects in co-operation		Rate of export revenue	Employees with Ph.D. degree	Common projects	Rate of governmental grants
	Number of research centres, universities	Growth of revenue		Strategy accepted by all members	Number of entrant engineers
Common requisite services		Investment in excess of description	Participation in EU R&D Framework Programme	Growth of revenue per head	First stage innovative products

(Source: www.polusprogram.eu)

The results expected are:

1. By 2013, there will be 5-10 successful pole innovative clusters formed;
2. Every successful cluster will possess measurable market share, also on European scale;
3. Every successful cluster will be organically connected to the global industrial value chain;
4 The international competitiveness of the SME sector will increase, with the development capabilities sector and its suppliers significantly raised;
5. The structure of employment will be improved; and
6. The role of the regions will strengthen through the pole cities.

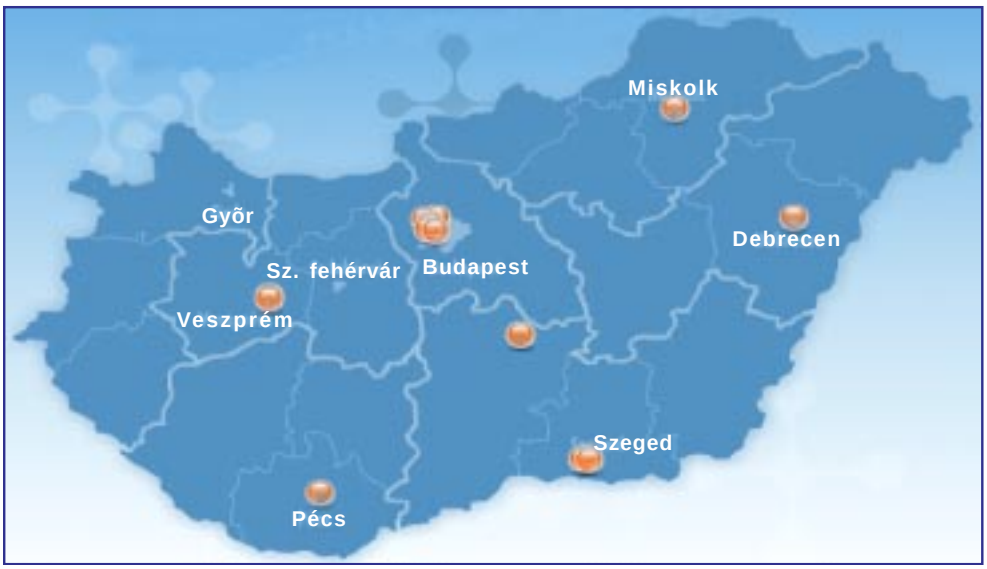
Currently, there is low level of networking in the regional economy and low amount of high value-added activity, and there are no market-orientated university competencies. Therefore the desired end results would be:

1. Internationally competitive clusters;
2. Specialization in high value-added, innovative activities; and
3. Strong cooperation among companies, universities and municipalities in order to maintain long-term competitiveness.

Pharmapolis Debrecen Innovative Pharmaceutical Cluster (www.pharmapolis-hungary.eu)

The Pharmapolis Debrecen Innovative Pharmaceutical Cluster is a legal network of people who aspire – on a profit-oriented or a non-profit-oriented basis – to enhance the

Figure 2.13: Accredited innovative clusters in Hungary



- Health Care Industry: 7
- Plastic, Packaging Industry: 2
- Informatics: 4
- Energetics: 1
- Environmental Industry: 2

added value along the value chain of the pharmacological industry, human biotechnology and functional foods. Alternatively, they perform activities closely related to these industries or complementary activities connected to these industries.

Composition of the cluster:

- Richter Plc. (leading pharmaceutical company);
- SMEs, spin-offs pursuing pharmaceutical R&D and innovation;
- University of Debrecen;
- Biological Research Centre of the Hungarian Academy of Science; and
- Institute of Nuclear Research of the Hungarian Academy of Science.

Aims and operating fields of the cluster:

1. Organization and execution of pre-clinical and clinical tests;
2. Production of materials and devices;
3. Pharmaceutical and biotechnological research;
4. Common participation in innovative research;
5. Development of supporting software;
6. Working out common project proposals/projects;
7. Common public relations and marketing activities, mainly for the SMEs; and
8. Cooperation with other pharmaceutical, food, industrial and biotechnological clusters.

The main products and services of the cluster are:

1. Innovative therapeutic products:
   - Formulation of recombinant drugs and drug candidates;

- Cell therapy and gene therapy; and
- Stress protein-based drug development.

2. Imaging technologies:
   - Preclinical imaging technologies in the pharmaceutical industry; and
   - Functional imaging, molecular imaging.
3. In vitro technological platforms:
   - Biomarkers; and
   - Laboratorial diagnostics.
4. Education module.

V. STRATEGIES, RECOMMENDATIONS AND CONCLUSIONS

In summary, the important aspects of cluster organization are:

1. Time-frame – 6-8 years are needed for the formation of a cluster from bottom up;
2. State of development of the region – the development strategy should act upon the realistic situation;
3. Wide range of incidence of modern business and market knowledge – there should be entrepreneurial awareness and adaptability needed for the recognition of mutual advantages and for the adaptation of innovations;
4. Readiness for cooperation among local entrepreneurs – trustworthy relations are required among the owners and managers of different companies;
5. Active roles of self-organizations and entrepreneurial organizations – the associations, professional organizations, chambers, clubs, etc. of entrepreneurs are very important, and the formation of clusters among SMEs could depend particularly on them;
6. Helpful local governments are needed who could manage the infrastructural and organizational developments and handle organizations according to the need of clusters;
7. Cluster-based governmental economy development should be exercised; and
8. Decentralized administration is needed – local municipalities should have appropriate autonomy regarding the necessary developments and to be able to plan (sources) on a longer prospective.

DISCUSSION 1

The background papers presented a conceptual framework of developing and strengthening HTCs. The discussions that ensued focused on these presentations, and participants elaborated their experiences on key issues and best practices in cluster development.

Mr. Jeong Hyop Lee stated that the Triple Helix model does not really work in developing countries because of unequal development. He observed that Mr. Mogyorosi's presentation of the Hungarian five-stage model is a very good model for cluster development. He also referred to the Korean model in which, during cluster development, there is pre-selection (while looking for potential champions) and a huge investment by the government. He emphasized the need for resources to make allowance for any kind of failures, and remarked that there was no other way for developing countries.

Mr. Somchai Chatratana pointed out that cluster formation must always be market-driven and profitable. He pointed out that all cluster members would want win-win cooperation. Beyond making money, elevated information level was another desirable outcome, he said. He underlined the need for giving incentives to foreign direct investors, as that would help local SMEs as well. He observed that while it was not very difficult to create a cluster, making it sustainable was a hard task. He pointed out the example of Thailand, where 150 clusters were formed but only 10 were working currently. He remarked that the creation of clusters was a contribution to wealth creation.

PART THREE

PRESENTATIONS FROM RESOURCE PERSONS (I)

KOREAN REGIONAL INNOVATION STRATEGIES

BY

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SCIENCE & TECHNOLOGY POLICY INSTITUTE SEOUL,
REPUBLIC OF KOREA

I. INTRODUCTION

Transformation into innovative clusters that are characterized as open and horizontal networks, and the continuous experimentation of creativity in locally embedded environment are not autonomous processes. As a region is exposed to a global competition environment, it would be confronted by changing forces for transformation. The regions that collectively respond to these forces would manage to become leading innovative clusters.

This paper, firstly, critically reviews the execution of regional innovation system (RIS) policies and achievements of the previous government of the Republic of Korea. Secondly, this paper identifies the changing forces and conditions of four Korean clusters and examines the possibility of their transformation into innovative clusters of horizontal networks. It also addresses the key issue of overcoming the legacies of developmental state model experiences that hamper the formation of horizontal networks in Korea. Lastly, Gumi Mobile Cluster – one of the four Korean cases – is examined through multi-scalar quantitative and qualitative analysis and its potential pathway to the innovative cluster is explored.

II. KOREAN RIS POLICIES: ACHIEVEMENTS AND LIMITATIONS

Diverse regional innovation programmes and strategies are at the centre of balanced development policies, and a nationally balanced development was one of the most important policy goals of the Korean government for the past five years.

This section explains the RIS policy programmes and tools used to create endogenous innovation systems for the promotion of target industries in the region, and reviews the projects of seven innovative clusters and the Daedeok Science Town. It also examines the achievements and limitations of the Korean RIS policies based on critical review and qualitative analysis.

A. RIS policy programmes and tools

Promotion of four target industries, the so-called "strategic industries", in 16 provinces and cities through infrastructure building, research and development (R&D) support, human resource development and coordination, and networking support was one of the major policy goals of Korean RIS in the past decade. These policy programmes and tools were initiated by the central government.

The two major programmes to create innovative clusters in the Republic of Korea were also important policy programmes of the previous government, namely:

- Transformation of seven industrial districts into innovative clusters through R&D capability enhancement of the district manufacturers with open networks among industries, universities, research institutes and government, and also improvement of residential and working environments of the districts; and
- Creation of a technology cluster through promotion of new spin-off firms, and facilitating technology transfer from public and private research institutes that have agglomerated since the early 1970s in the Daedeok Science Town.

Table 3.1: RIS policy programmes and tools

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

Table 3.2: Target industries of 16 cities and provinces

		Target Industries
Cities	Seoul	Digital contents, IT, BT, Finance
	Busan	Seaport logistics, Machinery parts, Tourism & convention, Film & IT
	Deagu	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, Culture
	Ulsan	Automobile, Shipbuilding & maritime, Precision chemistry, Environment
Provinces	Gyeonggi	IT, Life sciences, 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 nedicine, Culture & tourism
	Gyeongnam	Knowledge-based Machinery, Robot, Intelligent Home, BT
	Jeju	Tourism, Health & beauty bio, Environment-friendly agriculture, Digital contents

Table 3.3: Two policy programmes

		Target industry/activities	Location
Innovative clusters	Changwon	Machinery	Gyeongnam
	Gumi	Electronics	Gyeongbuk
	Ulsan	Automobile	Ulsan
	Banwol-Sihwa	Parts and components	Gyeonggi
	Gwangju	Photonics	Gwangju
	Wonju	Medical equipment	Gangwon
	Gunsan	Parts & components for machinery & automobile	Jeongbuk
Daedeok R&D special district		New business promotion through spin-offs and technology transfer from research institutes	Deajeon

B. Current conditions and policy direction of Korean RIS

The Korean RIS policies can be summarized as capacity building of the RIS actors, and the enhancement of their linkages through various networking and coordination programmes.

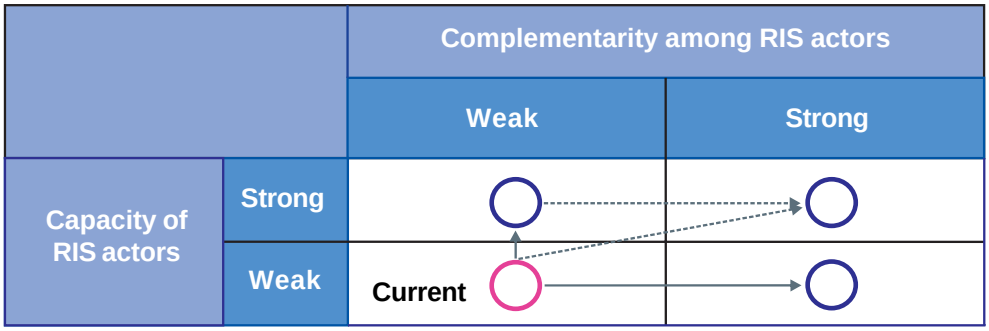
During the past rapid economic growth, regional public/private actors in the Republic of Korea were controlled by the headquarters in the capital region, which contributed to the current characteristics of regional actors – weak capacities and weak linkages.

The RIS policy interventions have had very limited achievements: limited capacity building and partial linkages that did not guarantee changing to the target status of strong capacities and strong complementarities.

A typical model of RIS policy intervention – large manufacturer-centred region, mostly south-east regions in the Republic of Korea – is as follows:

- Local universities and research institutes having various government R&D funds are required to cooperate with Techno Parks and Regional Industrial Promotion Centres to support local small and medium enterprises (SMEs); and

Figure 3:1 The Korean RIS policy



- SMEs are expected to produce better quality goods to supply to the local assemblers or encouraged to find other customers in and out of the region.

Figure 3.2: Guidelines with regional technology plan and road map

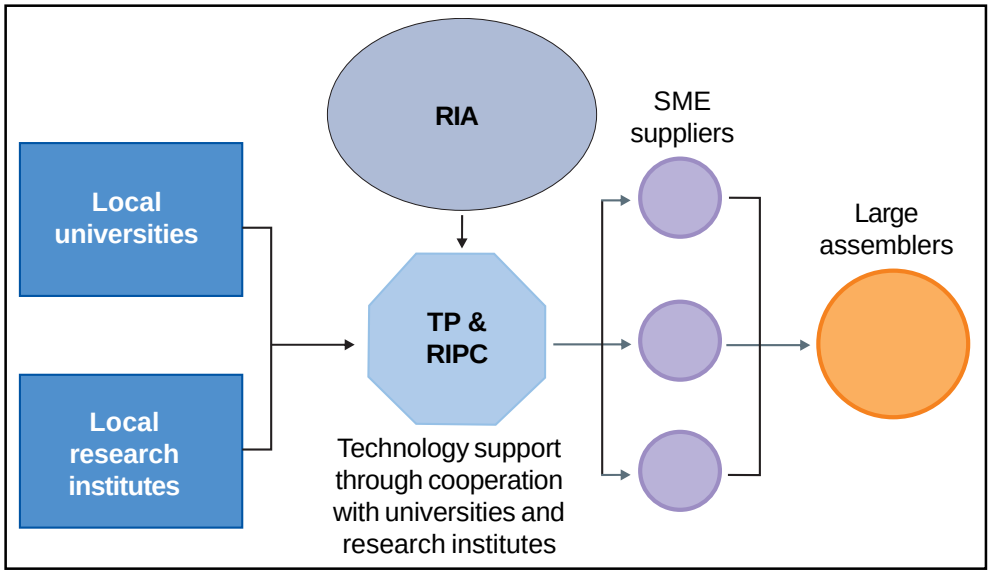
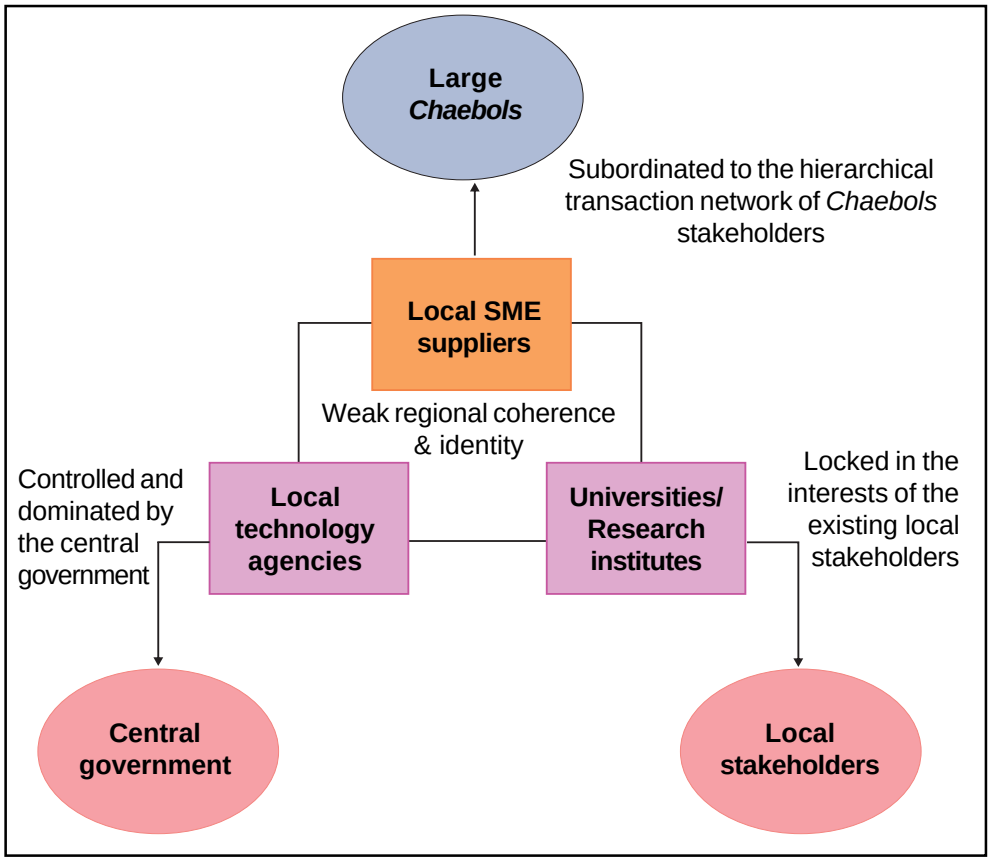


Figure 3.3: Limits of RIS policy intervention in the Republic of Korea



C. Achievements and limitations

With the support of the central government, local universities and research institutes began to produce various technologies for industry through R&D activities. R&D infrastructure, in the form of techno-parks and industrial promotion centres, was established in the region facilitating technology support for local SMEs.

However, 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 – the dominance of the central government on the entire regional innovation policy planning and execution, power imbalance between large chaebols, local suppliers and lock-in effects by the local stake holders – still hamper the successful transformation of the region.

PRESENTATIONS FROM RESOURCE PERSONS (II)

DEVELOPMENT OF HARD DISK DRIVE CLUSTER IN THAILAND

BY

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I. DEVELOPMENT OF INDUSTRY CLUSTERS IN THAILAND

Trade liberalization based on the World Trade Organization (WTO) agreement as well as trade integration in various parts of the world has severely intensified competition in the global market. Focus is on productivity aimed at lowering input costs and on developing a variety of new products that results in shortened product life cycle. It is obvious that global trade today is in a fast-changing environment and has become more complicated than ever. Only companies that are adaptable and quick to respond to rapid changes will survive. One of the factors for Thailand's economic regression in 1997 was that the local industrial sector, particularly small and medium enterprises (SMEs), lost its competitiveness in the global market, leading to the decline of manufacture for exports.

On 4 May 2003, Prof. Michael E. Porter, who was invited to be an Advisor to the National Competitiveness Committee [NCC], proposed six strategies, including industry cluster, to pull Thailand out of the economic crisis. The cluster vision proposed by Prof. Porter was that Thailand should become the world leader in niche markets. The five niche markets identified were:

- Food – Kitchen of the World;
- Fashion – Asia Tropical Fashion;
- Tourism – Tourism Capital of Asia;
- Automotive – Detroit of Asia; and
- Software – World Graphic Design Centre.

The Department of Industrial Promotion announced "Cluster Development Project" as a pilot project in food, textiles and automotive parts industries in 2003. Vice Prime Minister Mr. Somkid Jaturasripitak directed the Office of Economic Competitiveness Committee, National Social and Economic Development Board, to join the project. On 11 May 2003, the Director General of Department of Industrial Promotion, Ministry of Industry, launched the "Industrial Cluster Project".

II. CLUSTER FORMATION IN THREE INDUSTRIES AND THEIR EXPECTATIONS

Cluster formation was piloted in three industries and can be briefed as follows:

(a) Cluster in auto parts industry located in Bangkok and its vicinity – Being a strategic industry aimed at becoming the "Detroit of Asia" and its large size that covers interconnected industries gave it top priority in an attempt to form a cluster in the industry. The cluster was to have 50 members.

(b) Cluster in food industry in central region -– The reason for selecting this industry was that the industry itself had great potential to maintain its competitive success in the global market, thanks to the fertile farmlands that produced good quality food products. Besides, it was a strategic industry that offered high profits from value-added products. Hence, the government made it a policy to promote the industry with the aim to offer Thailand as the Kitchen of the World. This cluster too was to comprise totally 50 members.

(c) Cluster in garment industry located in Chaiyapoom – The cluster was to have 25 members from garment and textile companies, mostly relocated from Bangkok and other provinces to Chaiyapoom. The pilot cluster formation was timely and in line with the collective efforts made by the local public and private agencies to promote the textile and garment industry as a strategic industry in the province.

Since April 2004, a series of activities on cluster development has been going on in Thailand. The office of NCC, chaired by the Prime Minister, organized four cluster road shows in all regions of the country. Many new clusters were set up, for example:

- Hard disk drive (HDD) cluster;
- Black tiger shrimp cluster;
- Motorcycle parts cluster (SMEs 007);
- Ceramic cluster; and
- Fresh fruits and vegetables cluster.

The list above shows that HDD cluster was the only hi-tech cluster.

III. THE IMPORTANCE OF HDD CLUSTER

HDD cluster was important because Thailand was one of the world's largest production bases for HDD and related components. In 2004, Thailand had gained 19.9 per cent share of world HDD market with an export value of 483 billion baht (while imports were valued at 280 billion baht). The value added from the industry was 187 billion baht, which accounted for 3.2 per cent of the GDP. The industry offered 93,000 jobs.

In 2005, Thailand became the number one HDD exporter in the world and gained nearly 42 per cent of world market share. The export value of HDDs was 900 billion baht and the industry offered 116,000 jobs, a 20 per cent increase from the previous year. The data from the Board of Investment (BOI) in 2007 show that Thailand's production capacity of HDD totalled 204.6 million units, of which 204 million units went to overseas market. The value of HDD exports was US$10.55 billion. The world's top three HDD makers – Seagate Technology, Western Digital and Hitachi Global Storage Technology (HGST), which together control three-fourth of the global HDD market – have set up shop in Thailand.

IV. PLAYERS IN HDD CLUSTER IN THAILAND (2003)

Companies involved in HDD cluster can be classified as follows:

1. Head gimbal assembly, head stack assembly and HDD assembly – HGST, Fujitsu, Seagate, WD and Union Technology;
2. Motors – Minebea, Nidec Electronics, TDK and JVC Components;
3. Suspensions – KR Precision and Magnecomp;
4. Base plates – Altum Precision, Wearnes Precision, Bayonics, Shinei and MMI Precision;
5. Flex assemblies – Mektec Manufacturing, Innovex and PEMSTAR;
6. Other activities – Gem City Engineering and Thai Inter Calibration;

7. Governments agencies – National Science and Technology Development Agency (NSTDA), BOI, Ministry of Industry, and Thailand Electronics and Electricity Institute;
8. Academia – King Mongkut's University of Technology Ladkrabang, King Mongkut's University of Technology Thonburi, Khon Kaen University, Chulalongkorn University, Suranaree University of Technology, Asian Institute of Technology (AIT) and Thai-German Institute;
9. Associations – ECEA, Federal of Thai Industry and International Disk Drive Equipment and Materials Association (IDEMA); and
10. Overseas – Digital Storage Institute (Singapore).

V. THE HDD VALUE CHAIN

The disk drive value chain can be divided into five major activities as follows:

1. Component fabrication – These activities include manufacturing of disk drive components, such as substrate, media, head fabrication, wafers, semiconductors and bare PCBs, and miscellaneous parts assembly, such as base plate, screws, filters, etc.
2. Sub-assembly – The disk media components are sub-assembled into disk drive head parts and PCB parts.
3. Final assembly – The final assembly of a HDD requires assembling various components into disk heads consisting of motor, media and head stacks. The disk head will be finally assembled with finished PCB components to become a unit of a HDD.
4. Testing – The HDD will be tested in testing lines prior to distribution to customers.
5. Distribution – The distribution channels for HDD products include computer system manufacturers and HDD distributors that sell the products to computer makers or users.

VI. THE CHALLENGES OF THE HDD INDUSTRY IN THAILAND

Although the HDD industry developed well in Thailand because of foreign direct investment (FDI) and support from BOI in the form of tax incentives, there were still several obstacles to the further development of HDD industry. Some of these were:

- Complicated processing procedures in BOI and the Customs Department;
- Shortages of experienced specialized engineers (e.g. precision, contamination, etc.) and IT personnel for HDD industry;
- Weak linkages among universities, research institutions and industry; and
- Insufficient indigenous HDD supplier base.

A study by AIT/Asian Policy Research in 2003 on the technology capabilities of the HDD industry indicated that:

- The companies in the HDD industry had strong capabilities in investment, process development and industrial engineering that were required for manufacturing operations in Thailand;
- The companies had much weaker capabilities in product engineering and innovation;

- The companies had very weak linkages in product or process development, and human resource development (HRD) with suppliers or customers in Thailand; and
- The companies had weak links with universities, R&D institutions and service providers or with the competitors in their field.

VII. HDD CLUSTER AT NSTDA

The National Electronics and Computer Technology Centre (NECTEC) of the NSTDA had set up a HDD cluster to be a strategic cluster in 2004. In order to correct the weaknesses, the strategic plan of HDD programme focused on local HRD and local technology development. The objectives of Thailand HDD cluster development plan were:

- To maintain and increase foreign investment in the future;
- To strengthen and support electronics and other components industry;
- To develop production technology and other supporting technology for HDD industry;
- To create a HDD market in Thailand; and
- To increase HRD in HDD industry.

VIII. THAILAND'S HDD CLUSTER DEVELOPMENT PLAN

The activities related to Thailand's HDD cluster development plan from 2005 to 2010 can be categorized into four groups: (1) policy and incentives; (2) supply chain and cluster management; (3) focused R&D and technology; and (4) HRD.

The activities in 2005 included promoting HDD industry as the strategic national industry by bringing the problems and opportunities of the industry to the attention of the government through discussions with the Prime Minister. NECTEC and IDEMA executives discussed with BOI and established new and easy policies and/or incentives for supporting the HDD industry. A meeting with the Customs and Revenue Department was set up to simplify the processes in import, export and customs duties.

In the area of HRD, training courses were implemented to build up at least 800 engineers and technicians and 20 researchers per year to support the HDD industry.

In the area of technology development, R&D matching fund of 100 million baht per year was set up to promote R&D programmes related to HDD manufacturing technology, inspection technology and data storage technology among research institutes and universities.

A comprehensive logistics system for the manufacturing process (Rosetta NET) was introduced to facilitate global sourcing.

IX. HRD PLAN

As the problem of HRD was seen as a crucial factor to maintain the existing industry and attract new investment in the HDD industry, a comprehensive strategic plan was drafted with the following vision, mission and strategy.

A. Vision

Thailand becomes the number one centre for HDD manufacturing and related industry in 2010.

B. Mission

Preparation of skilled workforce for HDD industry through cooperation among university, industry and government during 2006-2010. Additionally:

- Recruit new workforce for the production line;
- Retain present workforce in the production line; and
- Recruit workforce that can conduct R&D for the HDD industry.

C. Strategy

- Development of curriculum for students and workers in HDD industry in 2006;
- Development of short course for students and workers in HDD industry through the HDD Institute in 2007;
- Development of Bachelor's, Master's and Doctoral degree programmes through the HDD Institute in 2006; and
- Development of cooperation between university and industry in R&D on HDD technology through the University-Industry Cooperative Research Centre in 2007.

X. EXAMPLES OF ACTIVITIES IN 2006

Activity 1

The activity focus was to create and support HDD technology R&D cluster in the up-stream level and transfer technologies. Several research programmes, funded by NECTEC, the private sector and joint sector were approved. Three Industry-University Cooperative Research Centres were established.

Activity 2

The HDD Technology Training Institute (HTTI) was established with Western Digital at Thailand Science Park. Forty-nine HDD training courses were developed and more than 700 engineers were trained.

Activity 3

The seminar on "Supply Chain Management in Hard Disk Drive Industry" was attended by 100 participants from the HDD industry. Twenty software developers were trained in Rosetta NET standard implementation.

Activity 4

Two studies related to policy and incentive development were conducted on "HDD Industrial Structure and Economic Value Added" and "Strategy for HDD Human Resource Development".

A. The role of IDEMA

The success of HDD cluster in Thailand was partly due to the active work of the industrial association IDEMA Thailand, the Thai branch of IDEMA, which is an international not-for-profit trade association that represents the US$22 billion HDD industry and its infrastructure. IDEMA Thailand was established in 1999 and its committee includes all large manufacturers, main suppliers and representatives from concerned government/education institutes, such as BOI, AIT and NECTEC.

IDEMA Thailand aims to be a platform for business networking & information sharing (through training courses, market updates and advanced technology seminars). It focuses on what Thailand needs – the development of human resources and automation infrastructure (e.g. with AIT providing Certificate of Competence in Storage Technology). In the area of policy and incentives, IDEMA Thailand worked with BOI to make HDD cluster a "prioritized" cluster receiving special tax privileges for investments. IDEMA Thailand assisted in establishing a HDD cluster managing organization led by an experienced cluster manager.

B. HDD cluster in 2008

The result of the efforts by members of the HDD cluster in cluster development could be summarized in the words of Mr. Mark Geenen, former President of IDEMA, who said in an interview in July 2008:

"Thailand is an attractive investment location for HDD investment with technical and supply infrastructure improving dramatically in recent years. Labour is plentiful and the location of Thailand is close to customer sites in the region. [But] costs will continue to be pressured, so the Thai government must be aware of this trend and offer ever-better incentives that provide ongoing savings for HDD companies."

PRESENTATIONS FROM RESOURCE PERSONS (III)

AGGLOMERATION AND DEVELOPMENT OF INDUSTRIAL CLUSTERS IN VIET NAM

BY

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I. INDUSTRIAL CLUSTER MODELS

Three accepted models exist for developing an industrial cluster:

- Model 1 – The concentration of manufacturing firms (related to) for typical goods or services in a geographical region. This was a widespread model in developing countries;
- Model 2 – A system of small and medium enterprises (SMEs) connecting to the same industry; and
- Model 3 – A pyramid model that includes main assemblers supplied by several sub-contractors (many tiers, like Toyota).

II. FEATURES OF INDUSTRIAL AGGOMERATION IN VIET NAM

There is little in terms of dynamic comparative advantages like human resources quality, supporting industry, technology, R&D and innovation. There is no fragmentation in industrial manufacturing, but there is little evidence of product value chain and production network. In terms of linkages, a weak linkage existed among enterprises in the region, in the form of spontaneous linkage and activities. Support from authorities, organizations and associations for relevant operations is very little.

In the case of a spontaneous industrial cluster in Viet Nam, its formation was truly spontaneous, with SMEs concentrating in the same industry by convention and location. The linkage, division and specialization were limited to the manufacturing stage. There was no support from intermediary partners and the effectiveness of the cluster was low.

There were different models of the cluster, but the necessities of industrial cluster model in Viet Nam are the same:

- Developing supporting industry and supply system;
- Developing local industry;
- Developing and enhancing capacity of SMEs; and
- Rapid integration.

The priorities in industrial cluster development are as follows:

1. Raise awareness of local leaders on industrial cluster development and prepare standard materials of training and handbooks for industrial cluster management used throughout the country to enhance linkage capacity and build trust among enterprises, especially SMEs;
2. Focus on region where spontaneous industrial clusters have already been formed, i.e. VMEP-Dong Nai, La Phu-Hanoi and Truong Hai Auto-Quang Nam;
3. Carry out pilot projects and spread them throughout the country; however, this model had to be organized well;
4. Approach to creating capacity for some small industries sectors, particularly mechanical, plastics and handicraft; and
5. Industrial cluster tool could be built as individual programme or referred to national industrial extension or programme on small industries development by the Ministry of Industry and Trade (MOIT).

Table 3.4: Situation of spontaneous industrial cluster in Viet Nam

Ord.	Industrial clusters	Activities	Linkage features
1	La Phu textile and garment	● 30 trading companies, 800 garment households and 5,000 satellite (spin-offs) households for processing of garment and textile ● 80% of products export to East European market	● Close linkage for manufacturing: exchange processed products ● New entry of trading connector (both input and output) in the cluster
2	Du Xuyen textile, Quang Nam	● 3 cooperatives, 12 manufacturing firms and 2000 households ● Each firms has around 30-100 looms, household has 4-5 looms ● Create job for about 3000 employees in the district ● Product: raw fabric (semi-final product) ● Market: HCM City and Hanoi, US export ● Advantages: tradition and labour	● Share order contract between cooperative and enterprises ● Exchange knitting phase between cooperative/firms and households through strict procedure ● Low product value chain through input linkage (cotton, fiber) and expand output production network (washing, boycotting, dying) as well as trading (exporting, sewing)
3	VMEP and parts producing enterprises in IZ Ho Nai 3, Dong Nai	● Manufacture, assemble motorcycle and its parts ● At present: 59 Taiwan makers in IZ Ho Nai 3 supply to VMEP and other motorcycle firms ● Supply to auto assembling (Toyota)	● Supply by tiers (pyramid model) ● Participation of local firms (regarding label, rubber, plastic and metal part) ● According to VMEP: market size is small to call for enterprises producing high value parts to invest in Viet Nam
4	Binh Dinh wood export processing	● 70 enterprises produce and process wood, targeting to outdoors export product ● Production scale: export from 5-10 container per month or up to 10-40 container per month (depend on season) ● 90% materials imported ● Serious lack of workers, weak management	● Cooperate to share large order contract ● Try to find the way to cooperate in sharing machinery and material order

III. A ROAD MAP

1. Period 2009-2012

During this period, a programme would work to raise awareness, and will include human resource training for cluster development, state evaluation and pilot project planning.

2. Period 2012-2015

This period would witness implementation of pilot projects. Monitoring and evaluation will play an essential role to record lessons learned from the pilot projects. The plan is to develop a database of industrial clusters throughout the country and a national programme on industrial cluster.

3. After 2015

This period would refer industrial cluster issues to local industrial policies and projects. MOIT would be the lead in-charge agency for cluster management.

The pilot project will have the following components:

- Study and analysis;
- Trust building;
- Action plan;
- Implementation; and
- Monitoring and evaluation.

Trust building involves organizing workshops on special issues, Q&A meetings, courses, training programmes, trade fairs, exhibitions and the development of a system of contract consulting.

Supply system development will entail:

- Multi-national corporations (MNCs);
- Exports;
- Supporting industry zones;
- Industrial clusters;
- Supporting industry concentration; and
- Business incubators.

By increasingly linking companies across industries, researchers across fields and consumers across markets, the business world is becoming one of partnerships and collaborations. Just as a vast majority of web content is now being created by web users, much of the business world's product innovation is now being produced by outside sources – everyone from experts to educators to everyday customers.

Table 3.5: Differences between closed and open innovation

Closed Innovation Principles	Open Innovation Principles
The smart people in the field work for us	Not all the smart people in the field work for us. We need to work with smart people inside and outside the company
To profit from R&D, we must discover it, develop it, and ship it ourselves	External R&D can create significant value: internal R&D is needed to claim some portion of that value
If we discover it ourselves, we will get it to the market first	We don't have to originate the research to profit from it
The company that gets an innovation to the market first will win	Building a better business model is better than getting to the market first
If we create the most and the best ideas in the industry, we will win	If we make the best use of internal and external ideas, we will win
We should control our IP, so that our competitors don't profit from our ideas *(Source: Chesbrough, 2003)*	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our business model

DISCUSSION 2

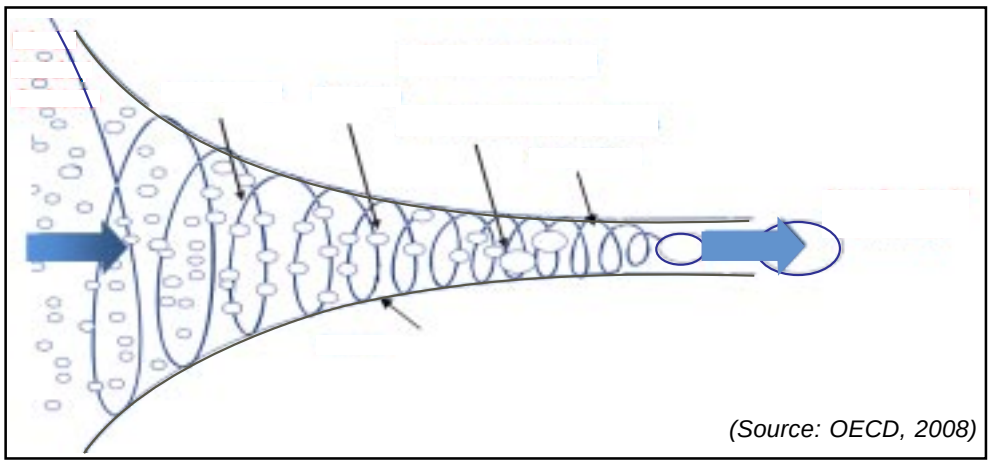
Following their presentations, the resource persons discussed the relationship between national, regional and sectoral policy and strategy. According to Mr. Mogyorosi, the difference was that the national policy and strategy did not set any priority, while the regional translation of national priority was based on regional competition and the sectoral set sub-priority within selected priorities.

Mr. Lee pointed out that clusters were only the regional manifestation of national strategy.

Mr. Chatratana spoke about the "rich man cluster", a cluster type that could demand anything from the government. He followed it with a reference to the "poor man cluster", identifying wood furniture cluster as an example.

As the second topic, the resource persons discussed open innovation. While open innovation was often mentioned, was it evident that innovation was always open? At the outset, Mr. Ramanathan clarified that innovation refereed to what was new and therefore, there was certain openness. However, the term 'open innovation' started from firms, he added.

Figure 3.4: Open innovation model



(Source: OECD, 2008)

Mr. Mogyorosi explained the open innovation model by quoting Chesbrough (2003):

"Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology."

Mr. Mogyorosi said that companies had to realize that not all good ideas would get developed within own company, and not all ideas should necessarily be further developed within own firm's boundaries. He further illustrated this by citing an example (Box 3.1).

Box 3.1: An example of open innovation

Recently, a leading Hungarian telecommunication company started a new open innovation project with the goal of introducing new services for their mobile communication subscribers. This company realized that the number of mobile phone subscribers would top in Hungary by 2009, so there was no real scope in the growth of mobile phone subscribers in Hungary. However, in order to maintain profit growth, they needed to introduce new services and applications to be used by existing subscribers. For this purpose, they launched the mentioned new open innovation project where basically anyone can attend.

PRESENTATIONS FROM RESOURCE PERSONS (IV)

REGIONAL PRACTICE FOR DEVELOPING HI-TECH INDUSTRIAL CLUSTERS

BY

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** The author could not participate in the workshop due to force majeure. However, his paper was made available to APCTT for circulation.*

I. STATUS, POLICY MEASURES AND OUTLOOK OF NATIONAL STIPS IN CHINA

It is known worldwide that science parks have played an important role in promoting enterprise innovation and start-ups, as well as in cultivating hi-tech industrial clusters since the 1950s. At the end of the 1980s, China initiated the construction of national Science and Technology Industrial Parks (STIPs), making continued and systemic exploration in their policy, infrastructure and institutional mechanisms. Currently, STIPs are strategically located all over China, acting as a critical component of national innovation system (NIS) and an important force for promoting national economic growth.

As a developing country, China carved out its own way with Chinese characteristics to cultivate hi-tech industrial clusters when constructing STIPs under the restrictions of an undeveloped market economy and insufficient innovation resources. As the experiences of China with STIPS might be of relevance for other developing countries, the background and status of Chinese STIPs and the Torch Plan that guides the development of hi-tech industrial clusters are explained below. The author also explores the ways in which to develop STIPs further and hi-tech industrial clusters while considering current challenges.

A. Establishment and evolution of STIPs

The construction of STIPs was a strategic mission for a developing economy and reforms to face the changing international economy and society. Since the 1980s, influenced by the new technology revolution on global economic and social sectors, the hi-tech industry had been intentionally promoted by most of the counties as an important way to recompose international competition structure. China too was faced with this historic opportunity to leapfrog in development.

As China reformed and opened up, construction was developed comprehensively. With the great aspiration for hastening economic development of the whole society, a development goal of China was to turn into one of the economically leading countries in the world. Meanwhile, the reformation of science and technology (S&T) institutions aroused the passion of S&T personnel for participating in economic development. It was the right time to accelerate S&T industrialization and develop hi-tech industry. Thus, the national STIPs came into being.

In 1985, the aim "to accelerate the development of new emerging industries, select a number of national intellectual resource-intensive areas, adopt special policies and gradually form new industrial development parks with different characteristics" was put forward by the central Government of China. According to the central policy, local governments became active in building new technology parks and S&T business incubators.

By the end of 1987, the Central Joint Investigation Team indicated that "building an economic giant needs the support of a considerable amount of hi-tech parks" and proposed the layout of 100 national STIPs.

In 1988, the State Council approved the establishment of the first national STIP – Beijing New Technology Industrial Development Experimental District. In the same year, the State Council renamed this as national STIPs in a unified way. Since then, STIPs started a new chapter.

Up to now, China has set up 56 national STIPs in intelligence-intensive areas, central cities, coastal open cities and old industrial bases. In addition, local governments established 106 STIPs at the provincial level.

B. Status of national STIPs

Catching the important strategic opportunity of the new technology revolution, national STIPs became one of the great achievements of China's reform and opened up the rapidly expanding the hi-tech technology industry. In 2008, the total gross revenue of national STIPs (54 in the statistics) reached about 6.60 trillion yuan; and the production value, industrial added value and export turnover reached about 2.10 trillion yuan, 1.25 trillion yuan and US$201.52 billion, respectively, accounting for 7 per cent, 9.7 per cent and 14.1 per cent, respectively, of the total share. Since 1992, the average annual growth rate of total operating revenue, gross industrial output value, profits, taxable income, export turnover and foreign exchange earned of the national STIPs exceed 40 per cent. Even under the impact of the global financial crisis in 2000, these indicators maintained a growth rate of over 17 per cent.

(a) Prosperous development of HTCs leading to continuous high growth of the economy

National STIPs formed an effective model for nurturing growth businesses and industry clusters and became the birthplace of emerging industries through concentrating innovation resources, incubating innovation and business team, and establishing a whole set of enterprise innovation and industry training system – from technical R&D, technology transfer and business incubators to the industrial agglomeration and clusters. The latest developing trends such as new energy, new medicine and other international industries were embodied in the national STIPs, and gradually spilt over throughout the country.

Currently, the output value of the communications equipment manufacturing industry in the national STIPs is 54.6 per cent of that of the whole country. Medical equipment and instrument manufacturing industry account for 46.5 per cent, while computer and office equipment account for 31.7 per cent. Aerospace and medical device manufacture industry make up 30.3 per cent and 24.5 per cent, respectively. Some industries in the national STIPs have become so successful that they have spread all over the country and even to other countries. Examples include Beijing Zhongguancun's chip design and bio-pharmaceutical R&D outsourcing, Shanghai Zhangjiang's integrated circuit manufacturing, Wuhan East Lake's optical fibre cable and laser equipment, Wuxi New District's solar photovoltaics, Changchun Hi-tech Zone's vaccines and genetic medicines, Baotou's rare earth materials and Baoding's new energy industries.

(b) Development of HTCs' roots in continuously enhancing innovation capability

After many years' efforts, the innovation system of national STIPs entered a healthy development phase with the characteristics of enterprises being main players, market-oriented functioning, and linkages among industry, university and research institutions.

In 2008, the number of enterprises of the national STIPs reached 53,000, 80 per cent of which were basic private enterprise. It had nearly 6,000 enterprises with scale exceeding 1 billion yuan, 99 with scale exceeding 100 billion yuan, and 927 public-listed enterprises. The wealth resources of enterprises were the main basis for the industry cluster innovation.

National STIPs contained more than 7,000 enterprises-based R&D institutions, more than 700 national engineering (technology) research centres and open laboratories, and nearly 300 inspection and testing units on industrial technology platform. Enterprise innovation of national STIPs and cooperation among industry, university and research institutions were very active, providing technical support for industrial cluster innovation.

In 2008, people with college degree in national STIPs reached 3.248 million, accounting for 45 per cent of the total number of employees, which included 249,000 with Master's and 32,000 with Ph.D. Nearly 29,000 personnel studying abroad were attracted by the STIPs to start business. R&D expenditure of enterprises in national STIPs was 165.82 billion yuan, providing technical resources guarantee for industrial innovation.

The technological level and innovation capability of enterprises in national STIPs have significantly improved. In 2008, patent licence for inventions from STIPs' enterprises reached 10,943, accounting for 50 per cent of the total patents approved in China. STIPs' per capita GDP was nearly 25.9 million yuan and its energy consumption per 10,000 GDP was 0.50 tonnes of standard coal, less than half the national average.

II. NATIONAL PLAN FOR SUPPORTING INNOVATION CLUSTERS: TORCH PLAN

Torch Plan was a guidance plan to develop China's new & hi-tech industries approved in 1988 by the national government. The mission of Torch Plan was to implement the strategy of revitalizing (invigorating) China through science and education and keep in line with the general policy of reform and opening up. The plan tried to make full use of the advantages and potentials in S&T strength and to take the market as orientation, prompt the commercialization of hi-tech achievements, industrialization of hi-tech commodity and internationalization of hi-tech industries.

With development of new economy, policy meaning and support measures of the Torch Plan were continuously enriched. Its current main function is – through the "Raising Seedlings and Afforestation" project – to achieve new breakthroughs at optimizing institutional mechanisms of hi-tech industrialization, integrate advantageous innovation resources from all sides, promote the leapfrog development of S&T small and medium enterprises (SMEs) groups and innovation clusters with international competitiveness.

From the perspective of overall scheme of the government's science programmes, the Torch Plan was connected with "973 Plan" to focus on basic research and with "863 plan" to focus on applied technology research. It emphasized on the "visible hand" of government guiding "invisible hand" of the market. As for the specific functions, "raising seedlings" aimed at individual innovation of S&T SMEs and "afforestation" at clusters' innovation of the entire industry.

A. Raising seedlings: Promoting innovation of S&T SMEs

The main mission of "raising seedlings" of Torch Plan was to provide support of public finance, start-up mentorship and business incubation according to the needs of S&T SMEs at different growth stages, especially for the "death valley" stage. The concrete measures adopted are described in the sections that follow.

(a) S&T Business Incubators

S&T Business Incubator is an important policy tool of Torch Plan. Since 1987, when the country's first such incubator was born, China has had 614 incubators. Among these, 197 are certificated as national incubators by the Ministry of Science and Technology (MOST). At the end of 2007, the all these incubators together covered an area of 22.7 million square metres, with 44,750 tenant enterprises, 933,000 employees, 25,214 patents and 262.19 billion yuan tenant turnover. Totally, 23,394 enterprises have emerged from these. Currently, China occupies the second place in the number of business incubators (following the United States) and first place both in total incubator area and number of tenant enterprises.

(b) SME Technology Innovation Fund

To solve the difficulty of financing S&T SMEs, in May 1999, the State Council approved the establishment of SME Technology Innovation Fund – a special government fund managed by MOST and supervised by the Ministry of Finance. The fund does not look to generate profit; the emphasis is on the projects that are at the early stages of industrialization, have high risks, and need government support urgently.

The aims of establishing the SME Technology Innovation Fund were:

1. To provide macro policy support and guidance from the government to nurture innovation, cultivate technology-based SMEs and develop the hi-tech industry; and
2. To attract regional governments, enterprises, finance organizations and venture capital (VC) to invest in technology-based SMEs.

In 2007, the central government allocated 1.1 billion yuan for the SME Technology Innovation Fund, taking the total innovation funding to 3.0 billion yuan. Up to the end of 2007, the Fund received 39,921 applications, of which 11,274 were approved with a total outlay of 7.43 billion yuan.

In 2007, the "S&T SMEs Venture Capital Investment Promotion Fund" was established within the Innovation Fund to guide private investments in start-up technology-based SMEs. The annual budget amount was 100 million yuan, which supported 397 venture investment projects.

(c) Hi-tech SMEs growth road map

The hi-tech SMEs growth road map aims to integrate various policy tools to support hi-tech SMEs in a comprehensive way and form a complete set of solutions. It includes the following aspects:

1. To reinforce the seed/early stage (death valley) financing. Besides supporting an expanded funding scale, it proposes a new model of "incubation plus investment";
2. To strengthen and promote the development of venture capital. It encourages and directs investment in S&T start-ups through subsidy and equity investment of "S&T SMEs Venture Capital Investment Promoting Fund";
3. To facilitate commercial loans to tech-based SMEs. The State Development Bank has provided policy loans to commercial banks, which in turn provide loans to tech-based SMEs, with collateral provided by Innofund; and
4. To promote the establishment of a multi-layered capital market system. An over the counter (OTC) equity market has opened at Zhongguancun as a pilot venture.

B. Afforestation: Promoting industrial clusters to develop into innovation clusters

The main mission of "afforestation" was to promote cooperative, networked innovation among enterprises through developing technological innovation alliances and networks. One of the main approaches was to strengthen the technological market to help access technical information at less cost and more convenience. The second was to push the transition from industrial clusters to innovation clusters by industry upgrading.

(a) Technological market

There are 19,646 technologies trading agencies all over China that engage in technology development, transfer, consultation and services. Along with the establishment of technology market system, technology trading has been increasing year by year and trade quality has continuously improved.

In 2007, 220,868 contracts were registered and transactions of 222.653 billion yuan (more than US$27 billion) recorded. The transactions per contract increased from 30,000 yuan to 101 million yuan, accounting for 0.90 per cent of the GDP of China. In 1990, it was 0.42 per cent.

(b) Upgrading Characteristic Industry Action

The "Upgrading Characteristic Industry Action" will form the "Industry Upgrading Road Map" to clarify the route and methods (i) to be the pivot of industry upgrading according

to the development norms of different industries and the understanding of global industry chain, value chain, supply chain and capital chain (which will be led by government), and (ii) rely on leading enterprises and cooperate with universities, research institutions and industrial associations.

The "Upgrading Characteristic Industry Action" aims to establish industrial bases, a technological innovation platform, relevant policies and a guarantee system. It will gradually promote the establishment of regional technological alliance and innovation system to support the cooperation of enterprises in the area of critical technologies. It will support enterprises in technological alliance to actively participate in constituting industry, national and international standards; supervise enterprises in the implementation of compulsory standards; and encourage enterprises to adopt international and advanced foreign standards.

III. OUTLOOK FOR DEVELOPMENT OF NATIONAL STIPS

Although China has achieved a high rate of economic growth in the past few years, it is still a manufacturing-oriented country rather than an innovation-oriented country. In 2006, the central government proposed to construct NIS, as a social system where the government is in a guiding position, the market plays a fundamental role in allocating resources, and the various actors in the system are closely interlinked to interact effectively.

As a national strategic plan, the STIPs have made notable achievements in both economy and innovation. But with the focus now on building an innovation-oriented country, the country is faced with several problems in the development of national STIPs. For example, the technical level in production is low, the technical structure remains irrational, the technological innovation capacity and the reserve strength for technological progress are weak, the regional development is unbalanced, and so on.

A. Understanding the key issues in the development of national STIPs

In retrospect, the development process of national STIPs provided the following lessons.

(a) Economies of scale do not imply competitiveness of industries

For the developing countries, economic development is people's top priority. However, it is wrong to aim at sheering quantity at the expense of quality. One should pay more attention to improvement of innovative capability and industrial competitiveness.

Taking digital video disc (DVD) as an example, China held only 9 out of the 57 key technology patents needed for DVD production and none of these nine patents was core technology. It was a fact that China was a major producer and exporter of some major IT products, including DVD, PC, colour TV and mobile phones but most of the key technologies were not in the hand of Chinese companies. Thus, the scale of production did not mean competitiveness. China tried best to move up the value chain and the brand-positioning chain.

(b) Industrial competitiveness is not equal to regional competitiveness

With the continuous development of economy and the advancement of S&T, the change in industry was natural. However, an industry at the high end of the value chain might bring prosperity for some time but would not necessarily be able to help the region establish a long-term competitive advantage. Therefore, development of industries had to be rooted in a certain region. Although regional competitiveness is just one fraction of the advantages in the economy, in the time of knowledge-based economy, it is the key to the innovation system. Taking the Silicon Valley for example, from the integrated circuit revolution in the 1960s to the revolution of the Internet in the 1990s, and then to the present innovative services and new energy, the Silicon Valley has been able to occupy the high-end of industry. It was the leader of the global trend in industrial development.

(c) Regional competitiveness is not economic competitiveness

Our understanding of STIPs was often limited to industries and economic sectors focusing on the function of wealth creation. From the view of the development of China's national STIPs, only with the co-development of technology, economy and social harmony was it possible to obtain long-term regional competitiveness.

It was simple logic that only by relying on innovative talents could the industry's innovation capability be upgraded. For example, if STIPs were only the accumulation of industrial parks, it would be a "dead city" at night. If there were no bilingual schools, hospitals, cafes, cinemas and residences, it would not be able to attract innovative people.

B. Development of the idea of national STIPs

In 2005, the central government put forward the idea of a new mission on China's national STIPs, which could be called "4 in 1". Key objectives of the mission were:

1. Important carriers to promote technology progress and reinforce indigenous innovation capabilities;
2. Powerful engines to push economic restructuring and growth mode transformation;
3. Service platforms to facilitate technology-based companies to compete in international markets; and
4. Forelands to take the commanding points of hi-tech industries.

According to this idea, the concept of innovative economy was put forward.

(a) A unified macro-orientation

In the second stage of National STIPs, the focus is to achieve "5 Changes":

1. Accelerate the change from resource/capital-driven to technology/innovation-driven model;
2. Push for the change from the model based on preferential policy or efforts to attract foreign investments, to optimizing innovation/entrepreneurial environment and capacity building model;

3. Promote the change from developing different industries to identifying a key industry and develop that industry by supplying it with more local resources;
4. Change from focusing on construction of hardware to optimizing configuration of technology resources and providing qualified services; and
5. Change from concentrating on importing overseas technology/product to developing domestic technology/product to expand into international market.

(b) The framework for classification

1. World-class STIPs – Beijing Zhongguancun, Shanghai Zhangjiang and Xi'an National STIPs have rich intellectual resources and very good economic foundation, like Silicon Valley. These STIPs should be benchmark for the world's leading hi-tech industrial parks, becoming a staging ground to lead the national economic development and national independent innovation demonstration areas;
2. Innovative STIPs – In Suzhou, Guangzhou, Changsha and other south-eastern coastal open cities and their STIPs, there already were large economies of scale. In the next phase their main objective is to build a regional innovation centre and a regional innovation hub and become the leading regional innovation economy; and
3. STIPs with clear characteristics – In Dalian, Baoding, Baoji and other similar cities, the development objective in the next stage is to build zones with local characteristics and the global competitiveness of industrial clusters.

(c) Quantitative development goals

Taking the construction of innovative STIPs as an example, referring to international management experience and evaluation index, China has put forward the 2015 aim of constructing the innovative STIPs based on the following:

1. For every 10,000 practitioners, the number of science and engineering degrees in undergraduate or higher levels is more than 2,500, reflecting the overall STIP environment and quality of creative talent;
2. The total investment in R&D in the STIP is more than 5 per cent of sales revenue, reflecting emphasis and input capacity in the hi-tech zone in R&D and technological innovation;
3. The funding of S&T in the STIP was higher than the proportion of total expenditure by 6 per cent, reflecting the park's financial capital intensity of investment in S&T activities;
4. For every 10,000 practitioners, every year, the number of invention patents is higher than 20, reflecting the high value of the output area of knowledge and capability for innovation;
5. The increasing rate of hi-tech industry is more than 35 per cent, mainly reflecting the level of hi-tech zones and enterprise technology ability to create value;
6. STIP formed more than one leading-edge industrial cluster, including an enterprise whose annual sales income is over more than 10 billion yuan (more than two companies with above 5 billion yuan in annual sales), reflecting the degree of focus of STIP on hi-tech industries;
7. The number of hi-tech enterprises in the park is higher than 50 per cent of the total number of enterprises whose income accounted for 60 per cent or more of the total park revenue reflecting the whole innovation capability in the enterprises in the STIP;

8. Hi-tech service business park revenues account for 30 per cent of the total business park income, reflecting the economic quality of the industrial structure;
9. The number of registered new technology-based SMEs with 500 million capital or less is higher than 60 per cent of the number of newly registered companies, reflecting the activity level of the hi-tech SMEs in the region for innovation and pioneering;
10. The number of various types of listed companies total above 50, reflecting the enterprise-scale operation and financing capacity in STIP;
11. The total operating income ratio of net profit is more than 8 per cent, reflecting the profitability of enterprises and the position in the industry value chain; and
12. The added value of energy consumption is less than 0.3 million tonnes of standard coal, reflecting resource efficiency in the STIP.

PRESENTATIONS FROM RESOURCE PERSONS (V)

INNOVATION CLUSTERS IN A DEVELOPMENTAL STATE MODEL COUNTRY

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I. ANOTHER PATH TO AN INNOVATION CLUSTER?

The essence of innovation clusters is crystallized as open and continuous experimentation of creativity in locally embedded horizontal networks (Saxenian, 2006). The horizontal networks were not automatically created in the diverse successful clusters without switching opportunities and forces. And they will lose their cluster dynamics if the dynamic forces are not sustained, because of the functional, cognitive and political lock-ins (Grahber, 1993).

Various paths to innovation cluster are reported – such as upgrading of a region/cluster in a global production network (Gereffi, 1999; Humphrey and Schmitz, 2002), technology transfer from multinational firms (Ernst and Kim, 2002) and exportation of advanced system (Depner and Bathelt, 2005; Ivarsson and Alvstam, 2005). However, most of them are very limited in the creation of clusters in catch-up economies.

The "brain circulation" is considered an effective way of transfer of open networks and decentralized experimentation of Silicon Valley by ethnic entrepreneurial networks into China, Taiwan Province of China, Israel and India (Saxenian, 2006).

The Republic of Korea was referred to as a successful model of a developmental state. The dominating power of large companies, combined with the autonomous and efficient coordination capacity of bureaucracy, has been the growth engine of the rapid economic growth of the country. The legacies of the developmental state have strong influence on the way large companies organize their production networks. And the power structure between large companies and their subcontractors has been accused of being a bottleneck for the smooth transition into an open and continuous experimentation of creativity in locally embedded horizontal networks that crystallizes the essence of innovation clusters.

Is there any chance to have innovation clusters in a developmental state model country that is characterized by vertical relationship between large companies and SMEs and their power imbalance? If there is a chance, what are the necessary and sufficient conditions to be transformed to innovative clusters?

Table 3.6: Cluster typology 1

		Knowledge type	
		Scientific/Analytic knowledge	**Synthetic knowledge**
Relational principle	**Community-oriented relationship**	Government initiated science park-based spin-off agglomeration such as Sophia-Antipolis	Handicraft industry agglomeration such as the Third Italy
	Society-oriented relationship	Agglomeration of technology entrepreneur like Silicon Valley	Large firm based subcontracting industrial system such as Baden Württemberg

Table 3.7: Switching forces to horizontal networks of successful clusters

	Characteristics	Switching force to horizontal networks
Baden Württemberg	Horizontal networks between big companies & SMEs	Expansion of externalization in scope diseconomy with requiring continuous innovation of suppliers from severe global market competition
Third Italy (Piore & Sabel, 1884)	Community-based flexible manufacturing system	Expansion of collective bargaining power against large companies through rapid market diversification and differentiation
Silicon Valley (Saxenian, 1994, 2006)	Open networks & experimentation of horizontal networks	Continuous change of dominant industry from defense (1950's), integrated circuits (1960's and 1970's), personal computers (1980's) to internet (1990's) (Henton, 2000)
Sophia Antipolis	Diverse thematic networks	Crisis driven spin-offs and their inevitable interdependencies (Longhi, 1999)

A. Cluster typology and developmental paths

Clusters could be classified by the criteria of knowledge type (Asheim and Gertler, 2005) and relational principle (Storper, 2005). Horizontal networks of the clusters in each cluster type were not automatically established; the collective responses of the regional actors to the switching forces and opportunities built up the current characteristics of innovative clusters.

B. Potential pathways of Korean industrial agglomerations to innovative clusters

The same typology can be applied to four Korean cases: Daedeok bio cluster, Dongdaemun fashion cluster, Gumi Mobile cluster and Ulsan automobile cluster. These four industrial agglomerations had specific conditions to be transformed as innovative clusters, which were constituted during the rapid economic growth driven by the developmental state model and their specific knowledge base and relationship principle also contributed to the future path of development.

Table 3.8: Cluster typology 2

		Knowledge type	
		Scientific/Analytic knowledge	**Synthetic knowledge**
Relational principle	**Community-oriented relationship**	Daedok bio cluster	Dongdaemun fashion cluster
	Society-oriented relationship	Gumi mobile cluster	Ulsan automobile cluster

Table 3.9: Formation and developmental path of the Korean clusters

	Ulsan automobile	Dongdaemun fashion	Daedeok bio	Gumi mobile
Origin	Agglomeration of suppliers around Hyundai auto since 1969	Agglomeration of clothing producers driven by national wholesales market function	Agglomeration of public & private research institutes since early 1970's in Daedeok Science Town	New firm creation & moving-in of suppliers for Samsung Electronics
Strength	Strong engineer networks between suppliers and Hyundai	Purchase-driven production system that can produce various kinds of design in short period	Technology spin-offs during and after the financial crisis and government support	Expansion of global market share of mobile phones and continuous outsourcing of Samsung

Table 3.10: Formation and developmental path of the Korean clusters

	Ulsan automobile	Dongdaemun fashion	Daedeok bio	Gumi mobile
Crisis	Moving out of the region of Hyundai R&D Centre & production lines	Competition with cheap Chinese clothing while local production system shrunk	Moving out of the region into the capital region of strong companies	Saturation of global market and outsourcing strategy change of Samsung
Oppor-tunities	First suppliers' capacity build-up of product & process enhancement	Design and production capacity of local producers	Collective activities of spin-off companies and expansion of government support	Software & hardware developers who have core technology capabilities
Future direction	Local production system based on global sourcing expansion of suppliers	Fashion hub for East Asian fashion market	Global marketing and networking for the local technology firms	Local production system based on collective networks of technology suppliers

C. Spatial evolution of the clusters in a multi-scalar framework

Clusters are not geographically confined phenomena but they have knowledge networks and backward/forward linkages in a multi-scalar framework of global, national and local dimension. As they evolve from the mere agglomeration of industrial activities to innovative clusters of horizontal networks and active relationship building with each other, their spatial boundaries also continue to expand and include other spatial dimensions. Most of the Korean clusters were built up by the strong central government interventions and

legacies of developmental state model experiences were imprinted in their spatial evolution patterns. Thus, the national space was the most influential spatial dimension in beginning of the cluster. Each cluster has different knowledge base and the relationship principle has its own distinct evolution path. Collective actions of cluster actors triggered by policy interventions are required for the successful transformation of clusters.

Daedeok was formed as a science town since early 1970s by the central government and its mission was to supply technologies for the whole nation. It now also serves as a hometown of technology spin-offs from the research institutes that were nurtured by the local technology networks and various supports of the central government.

By the policy supports for global marketing and networking, the technology spin-offs listed on the stock market were able to constitute an innovative cluster that could realize their technologies in the global market.

The local production system of Dongdaemun was formed to provide garments that were sold in the wholesale market and capacities of design and production were enhanced to produce various fashion clothes in a short period. Although its production system is now threatened by the rise of Chinese garment producers, it still has a chance to be a fashion hub in the East Asian market through strategic channelling production networks of domestic suppliers and factories in the Democratic People's Republic of Korea and China.

Ulsan is the hometown of Hyundai auto since 1969. Car parts and components were delivered from the capital region in the beginning. As Hyundai expanded its car production, suppliers began to agglomerate in the region. The Ulsan production system was confronted with two harmful forces – Hyundai production lines moving to other countries and second and third quality suppliers also moving out to developing countries. Collective production networks nurtured through policy engagement could help first and second suppliers to produce quality products to sell in the global market.

II. FORMATION AND SPATIAL EVOLUTION OF GUMI MOBILE CLUSTER

A. Introduction

The Republic of Korea has been well-known as a catch-up model based on reverse engineering conditioned by the developmental state planning. These characteristics formulated during the rapid economic growth period since the 1960s also constituted the mobile production system in the country. The Korean mobile industry did not develop its own original technologies but borrowed them from advanced countries. The industry was based on the very hierarchical structure of business between large companies and suppliers and continuous innovation based on interactive learning between them was not usual.

Could the mobile phone industry formulate the open networks and horizontal experimentation in such an environment? And if possible, what are the conditions for switching to innovation clusters?

Table 3.11: Different kind of levels

	Data	Method
Global level	UN COMTRADE statistics of telecommunication equipment and parts (group 764) trade data from 1995, 2000, and 2003.	Social Network Analysis (SNA)
National level	Korean input-output table (2000) and their location pattern changes and R&D networks of Samsung Electronics from national industrial R&D data (2005)	
Local level	Analysis of networks of major local innovation actors using the 2005 STEPI Innovation Survey	

Before the case study of Gumi, the positional change of the Republic of Korea in the East Asian production networks of telecommunication equipment, the identification and structural characteristics of domestic information technology (IT) production network (compared with R&D networks of Samsung Electronics) and its spatial pattern changes, and local knowledge networks were analysed using Social Network Analysis method with trade data, Korean industrial R&D data, the 2005 STEPI innovation survey results, etc. The structural characteristics of the new cluster were figured out through these spatially multi-scalar network analyses.

B. Multi-scalar analysis of Korean mobile phone industry

The global production networks in telecommunications were triggered (and are dominated) by the major five companies – Nokia, Motorola, Samsung, Sony Ericsson and LG – as some of them relocated their actual manufacturing activities to low-cost sites (Hess, 2003).

In the East Asian telecommunication production networks, the position of the Republic of Korea rose rapidly, dominating them in 2003 (Figures 3.5-3.7). East Asia was then the most rapidly growing market in the world. The mobile phone industry of the Republic of Korea still occupies a dominating position among the East Asian telecommunication production networks.

Table 3.12: Growth of telecommunication networks

	1995	2000	2003
In-degree centrality	0.182	0.273	0.273
Out-degree centrality	0.364	0.364	0.909

The success of Samsung and LG in the East Asian telecommunication production networks was nurtured by the balanced developed domestic IT networks, which also reflected the vertical networks of large companies and SMEs and would lead the continuous evolution of the networks. The Samsung network also features R&D networks, SMEs in the capital region, diverse universities and government research institutes (Figure 3.9).

Local companies are still dependent on the private knowledge sources in the capital region with government-sponsored relationships with universities and government research institutes at local and national level.

Figure 3.5: East Asian production network of telecommunications (1995)

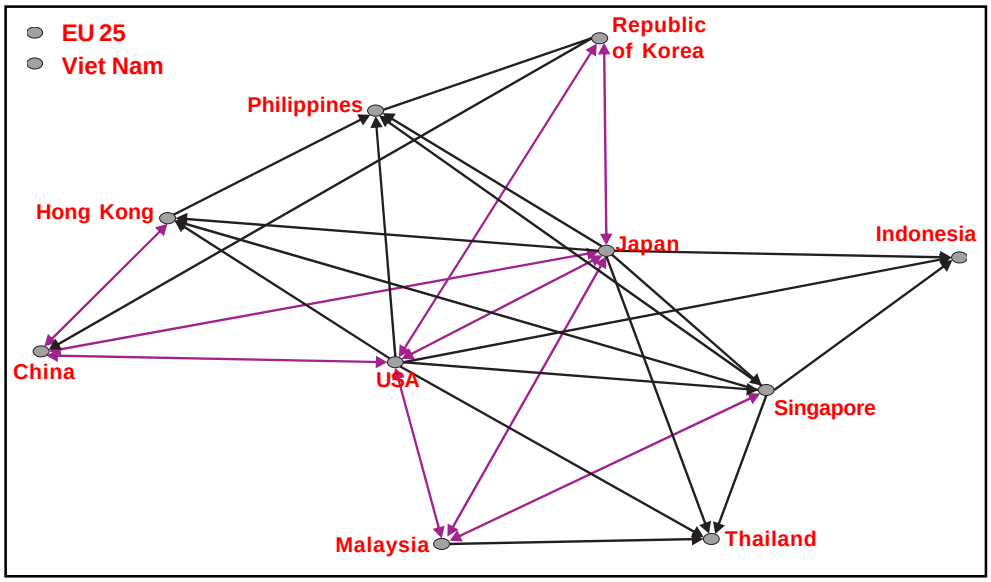

Figure 3.6: East Asian production network of telecommunications (2000)

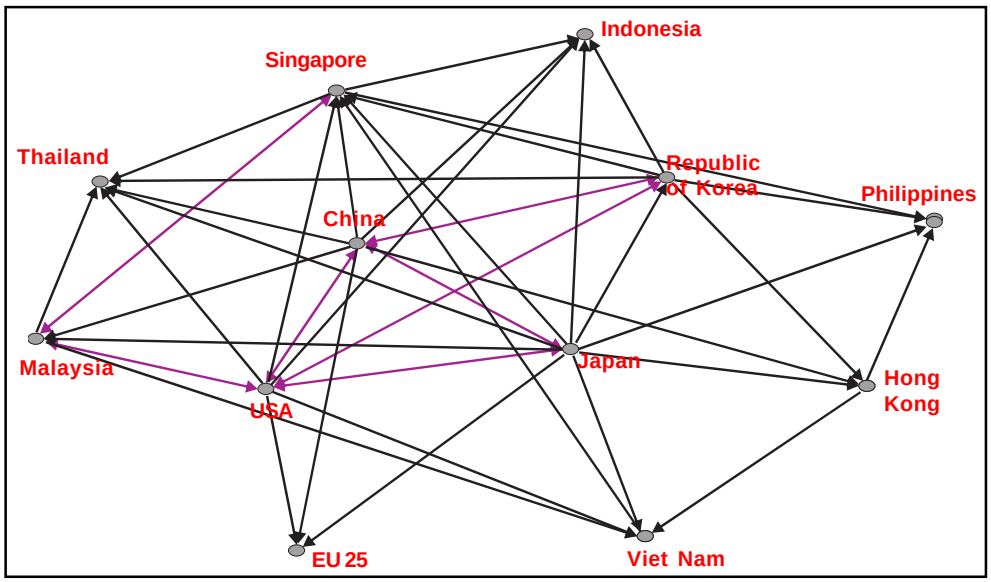

Figure 3.7: East Asian production network of telecommunications (2003)

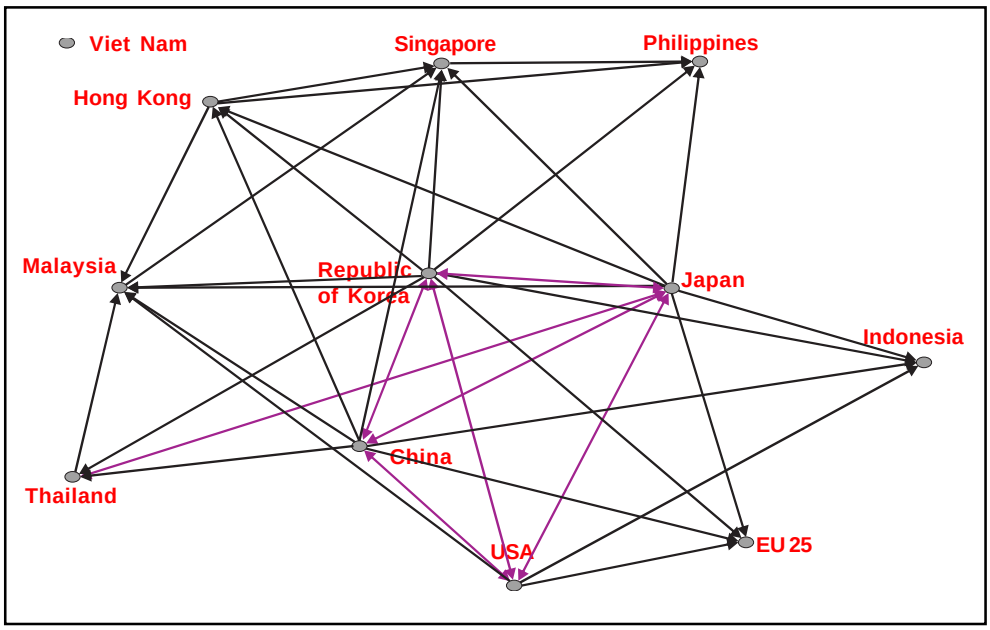

Figure 3.8: Balanced evolution of national production network of the Korean IT industry

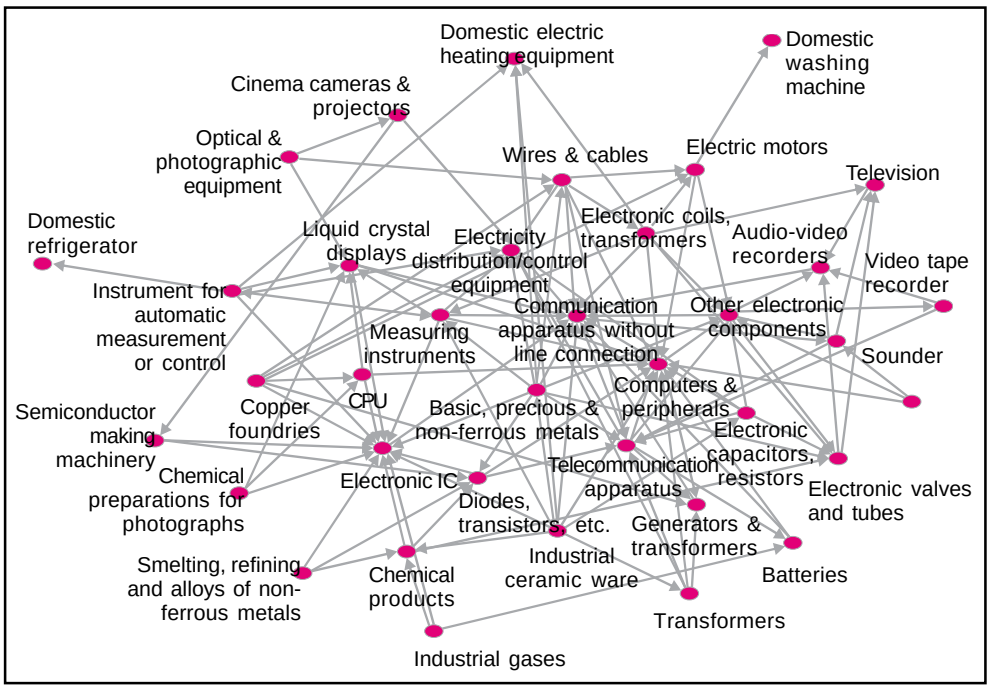

Figure 3.9: Nationwide network of Samsung Electronics

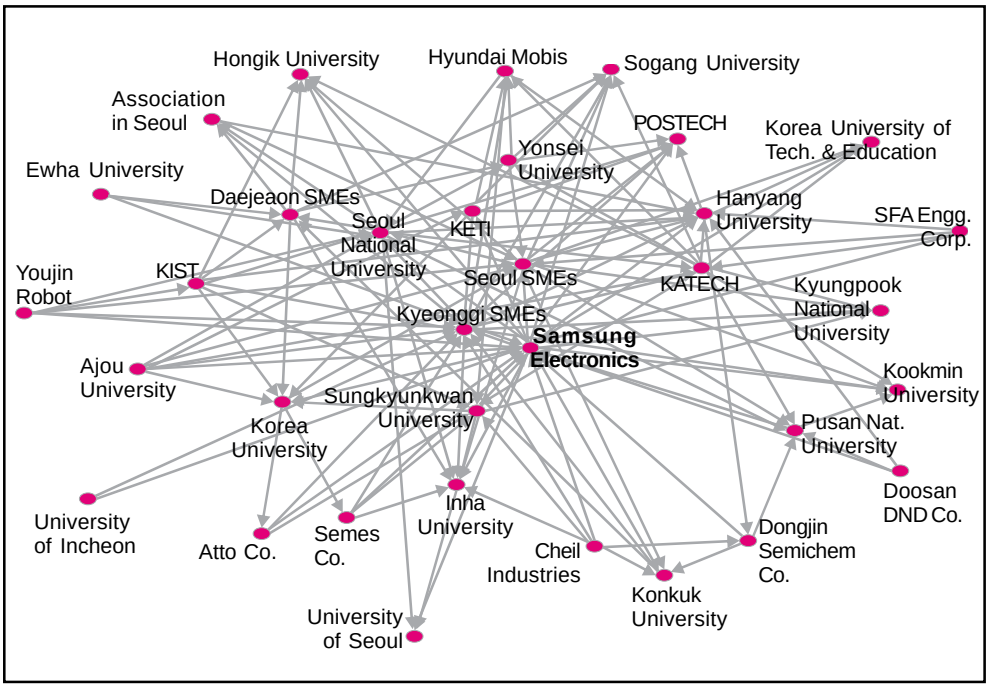

Table 3.13: "Closeness" – "Betweenness"

Closeness		Betweenness	
R4 (GRIs in the Central region)	1.132	P1 (PRIs in the Capital region)	0.301
U2 (universities in the Southeast region)	1.121	P3 (PRIs in the Southwest region)	0.037
U4 (universities in the Central region)	1.062	P4 (PRIs in the Southeast region)	0.037
U3 (universities in the Southwest region)	1.062	P2 (PRIs in the Southeast region)	0.001
R3 (GRIs in the Southwest region)	1.061	U2 (universities in the Southeast region)	0.001
R1 (GRIs in the Capital region)	1.051	U1 (universities in the Capital region)	0.001

C. Case studies of Gumi Mobile cluster

(a) Method and data

The characteristics, formation and spatial evolution to innovation cluster of Gumi region were examined based on the exhaustive interviews with four typical suppliers of Samsung Electronics.

Table 3.14: Gumi cluster data

	Established in the region	Moved from other region
Components & parts		Company S
Hardware development	Company G	Company N
Software development	Company F	

b) General mobile phone production information of the region

Daegu/Gyeongbuk produced more than 50 per cent of the total mobile phones in the Republic of Korea and GSM covered almost three-fourths of the regional production. Samsung Electronics is located in Gumi, Gyeongbuk.

It is reported that there are 353 mobile phone companies in Daegu and Gyeongbuk region. Gyeongbuk specialized in the production of hardware (86.0 per cent), such as terminals, components and parts and material, while Daegu had more companies in software (52.7 per cent), such as digital contents, solutions, network services, etc. The difference reflects that Daegu is the central city of the region where quality lives, good business services, sophisticated education are available.

Table 3.15: Mobile phone production by region and technology (2004)

	CDMA	GSM	Others	Total
Seoul	85.7	12.8	1.5	486 (14.3)
Gyeonggi	75.3	21.6	3.1	406 (11.9)
Daegu/ Gyeongbuk	27.6	72.3	0.1	1,779 (52.2)
Central region	10.9	88.9	0.2	386 (11.3)
Gyeongnam	30.4	69.6	-	342 (10.0)
Others	54.1	1.0	44.8	9 (0.3)
Total	40.0	59.2	0.8	3,407 (100.0)

Source: Korea Association of Information & Telecommunication, 2005 Annual Statistical Report of IT Industry

Table 3.16: Number of mobile companies by region and product type

	Hardware	Software	Others	Total
Gyeongbuk	86.0	7.7	6.3	207 (58.6)
Daegu	33.6	52.7	13.7	146 (41.4)
Total	64.3	26.3	9.4	353 (100.0)

Table 3.17: Formation of the mobile cluster

	Year of establishment (movement)	Background of establishment/ moving to the region	Location of HQ
Company F	1997	Gyeong-buk National University	Daegu
Company G	2002	Retired from Samsung Electronics	Gumi
Company N	2000 (2005)	Spin-off from ETRI, induced by Daegu city government	Daejeon → Gumi → Daegu
Company S	1987 (2003)	Automobile components Supplier, recommended by Samsung Electro-Mechanics	Gyeonggi → Gumi

(c) Formation and spatial evolution of mobile cluster

The mobile cluster in this region had been rapidly formulated since 2000. Some of them were established in the region and others moved to supply to Samsung Electronics.

The major force of the cluster formation was the outsourcing strategies of Samsung Electronics. Technological and market uncertainties led Samsung to expand its outsourcing strategies. And its sharp expansion of telecommunications sales in the global market drove the rapid expansion of local agglomeration of mobile companies. The sales of Samsung Telecommunications increased from 12,391 billion won in 2002 to 18,935 billion won in 2004, a 65.4 per cent increase in two years. Driven by Samsung, most of the contract suppliers also grew very rapidly in sales and number of employees. The competitiveness of Samsung was the major source of cluster formation in the region.

Table 3.18: Sales of Samsung Electronics (in billion Won)

	2002	2003	2004	2005
Telecommunications	12,391	14,202	18,935	18,817
Total	40,511	43,582	57,632	57,458

Table 3.19: Core technologies accumulated through partnership with Samsung

	Area	Core technologies accumulated
Company F	Software development	Mobile DBMS, Data synchronization
Company G	Hardware development	Radiation technologies, Static electricity management technologies
Company N	Hardware Development	Fusion of wire & wireless technologies
Company S	Components & parts	New Material Die casting, Technologies to deal with electromagnetic waves, environmental issues, etc.

Table 3.20: Suppliers responses in possible threats

	Resonses
Company F	PMP development/marketing, Marketing mobile solution technologies
Company G	Mobile functional phone accessory development/marketing
Company N	Privacy phone development
Company S	Development/marketing automobile components

Most of the contract suppliers accumulated core technologies while they had contract relationship with Samsung Electronics. Interactions between Samsung and suppliers were the main sources of technology transfers and their capacity building with global leading technologies in designs and a very strict quality control.

The suppliers were always exposed to the threat of cutting down their contracts with Samsung. In the early 2000s, the restructuring of Samsung suppliers took place twice. Samsung had also invested in Gumi R&D facilities, which was very positive in terms of regional R&D capabilities building but had negative impact on the software and hardware developers because of the possibility that Samsung might internalize their developments. These possible threats led most of the suppliers to pursue their own survival strategies.

(d) Build-up collective networks of technology companies by policy interventions

Most of the suppliers are trying to develop a few new products, such as portable multi-media player (PMP), or enter new hardware or software solution markets. There have been no collective efforts to cooperate with each other. More recently, the suppliers have begun to recognize that the technologies other suppliers have accumulated could be very useful for the development and enhancement of their own products and technologies. The collective networks are not easily formulated because there has been no leader and most of the companies only had contractual relationship with Samsung. The collective networks can be triggered by the diverse policy interventions and the project ecology (Grabher, 2005) that provides the social and organizational fabric for temporary and recurrent project collaboration of core capabilities that need to be constituted.

III. CONCLUSIONS

1. In the case study of Gumi Mobile Cluster, the sub-contracting companies of Samsung mobile phone were trying to formulate horizontal networks. Most of them had rapidly grown in size and possessed certain key technologies with their strong partnership with Samsung.
2. The agglomeration of these technologically strong companies in the area could be traced back to the strategic change of Samsung. Samsung is currently leading the technology market of mobile phone; it had adopted and continuously expanded outsourcing strategies not only for components and parts but also for the development of hardware and software of mobile phones because of the market and technology uncertainties.

3. The potential crisis that might be driven by Samsung had confronted the technology companies and triggered them to develop their own market products and search for horizontal partnership with other technology companies. This was the beginning of innovation cluster in the large company-dominating economy.

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PRESENTATIONS FROM RESOURCE PERSONS (VI)

DEVELOPMENT OF SUB-SECTOR INNOVATION NETWORK IN FURNITURE INDUSTRY

BY

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Wood and furniture industries are two industries in which Thailand has had many competitive advantages in the past due to abundant raw material, such as teak wood and pará rubber (Hevea brasiliensis) wood, and a highly skilled workforce. Wood and furniture industries provide more than 200,000 jobs in more than 8,000 factories, with an export value exceeding US$1 billion. The factories related to these industries are sawmill, heat and chemical treatment factory, furniture factory and wood pellet factory.

The trees from pará rubber plantations are processed into logs and wood planks. The planks are transported to the treatment factories for chemical substances treatment and heat treatment to kill wood pests and fungi and to prevent the planks from bending, twisting and cracking. The treated wood planks are used in construction and furniture. The wood waste from sawmills could be processed as material for flooring and firewood. The wood waste is transported to the chip mill to be chopped into wood chips, which is used to produce chipboard. Trees trunks of smaller diameter could be used directly as wood posts. The logs are also processed in veneer mills into veneer that is used for surfacing in plywood.

In recent times, the wood and furniture industries have lost their competitive advantage due to the stiff competition from neighbouring countries, such as China, Malaysia and Viet Nam. Malaysia is more advanced in terms of technology and design while China and Viet Nam are more competitive in terms of low cost and high volume.

iTAP is an activity under the Technology Management Centre, National Science and Technology Development Agency (NSTDA). It provides technical consultancy services to SMEs from a pool of experts, from both local and foreign institutes. The Industry Technology Advisors from iTAP visit the companies to diagnose the technical problems and bring experts to the companies to give consultation on site. The project duration ranges from 3-6 months. iTAP partially funds the consultancy fee of the experts.

From 2004, iTAP conducted eight programmes to develop the competitiveness of wood and furniture industries:

1. Technology development for competitiveness of wood industry (2004 onwards);
2. Tools for executives of Thai furniture industry (2006-2007);
3. From Idea to Market – development of Thai furniture industry (2008-2009);
4. Strategic road map for sustained Thai furniture industry (2008-2009);
5. Analysis of needs and interests of companies in wood furniture industry (2008-2009);
6. From Waste to Wealth – create value from waste to fight global warming (2008-2009);
7. Design project for world market (2009); and
8. Green furniture factory (2009-2011).

iTAP realized the problems of wood and furniture industries and set up many activities to help the industries develop their competitiveness since 2004. The activities included conducted seminars to create awareness for more than 1,000 companies all over Thailand and visits to more than 200 companies for problem identification. iTAP organized six technology acquisition trips to many countries for more than 100 companies. More than 120 companies have conducted long-term technical consultancy projects with iTAP experts. One company had licensed the manufacturing process of cement wood from NSTDA.

Technology development in Programme 1 was a tailor-made activity to take care of all needs in technology development of the wood and furniture industries. The theme of consultancy projects ranged from technology development for sawmill, wood processing, wood treatment, productivity improvement and new technology in woodworking to technology for other types of furniture, such as leather, metal and upholstery.

After working with the companies for more than two years and participating in some group activities in technology acquisition in foreign countries, iTAP and the Thai Furniture Industry Association (TFIA) concluded that most of the owners of the companies had very little knowledge in modern business management. The owners were either educated in other disciplines or developed woodworking skills on their own. Hence, a programme similar to mini-MBA was set up for the owners of the companies. The curriculum included manufacturing techniques, marketing for the export market and branding. The participants were required to attend classes and workshops. This programme was designed to equip the executives with management tools, marketing tools and branding tools.

The companies that were involved in Programme 2 realized the importance of competitiveness and identified the need of design as an essential element to become original design manufacturers. iTAP and TFIA jointly organized Programme 3: From Idea to Market. This programme aimed to introduce the design concept from the market point of view or commercial design.

The first module of the programme was design and marketing, which was conducted from August 2007 to April 2008. Twelve companies joined this module. The second module was on productivity improvement, which was aimed at bringing the design to the production line so that the design could be realized as a product with competitive cost.

Apart from iTAP and TFIA, other partners in this programme were:

- Kasetsart University;
- King Mongkut's University of Technology Ladkrabang;
- King Mongkut's University of Technology North Bangkok;
- Thai-Japan Technology Promotion Association; and
- Thailand Productivity Institute.

Activities in the first module of Programme 3 included 8 seminars in design concepts, 5 seminars in marketing, 12 company visits, design workshops in 12 companies, exhibition of design works in Thailand International Furniture Fair 2008, technology acquisition trip to Hong Kong S&T Parks, Business of Design Week, the Hong Kong Polytechnic University, retail shops and a local technology acquisition trip to a leading design company, Thailand Creative and Design Centres, Faculty of Architecture, NSTDA.

To identify the future trends of technology, products and business modes of different sectors of the furniture industry, a strategic road map was developed with the help of experts of Asia-Pacific Economic Cooperation (APEC) Technology Foresight Office. This was Programme 4 for the sector.

In Programme 5, a group of researchers from Kasetsart University was commissioned to conduct the "Analysis of needs and interests of companies in wood furniture industry".

This was to identify the design, development and engineering needs of the companies related to the results from the strategic road map. Themes, such as design for export market, eco-design, environmental issues and green manufacturing, were identified as threats and opportunities.

In 2008, Programme 6 "From Waste to Wealth" was conducted with Kasetsart University. The slogan for this programme was "Slow Global Warming, Delay Climate Change and Add Value to Waste".

With Mr. Singha Intarachooto as the lead expert, the companies joining the programme were expected to understand the issues of environment and be able to integrate the knowledge on design, use of material, production technology to create innovation in environment protection, ecology and economy. It was hoped that the success of the programme would create networks of private sectors and government offices for environment protection, leading to actions to fight global warming.

Three companies joined the programme – Deesawat from the wood industry, Grandness from the textile industry and Siam Global Engineering from the steel industry. After six months of serious engagement, these companies developed very innovative products. Their design works, which were exhibited at the Thailand International Furniture Fair 2009, received great attention from the public. Although it was not intended to sell the designed work during the exhibition, many pieces were sold after the exhibition and limited new orders were received from some eco-tourism operators.

By then, some of the companies were ready for the world market, so the Design Project for World Market was created. The Furniture Design Techniques were carried out by Japanese experts from the Zero First Design with four companies during March and May 2009. The Japanese experts were: Mr. Kiyoshi Sadogawa (Team leader); Mr. Mikiya Nagai; and Ms. Tae Suzuki.

Four companies joined this programme: Pimpen Co. (upholstery), Performax Co. (water hyacinth braided items); Deesawat Industry Co. (teak furniture); and FBCM Co. (steel and wood furniture). The design theme was "Future Natural", which could be translated into three sub-themes as sky (or air, weather, space, heaven), land (or landscape, earth, rock) and life (or human, animal, organic). The works designed were exhibited at iSALONI 2009 in Milan, Italy. The pavilion was very popular and the companies were contacted by many new customers interested in the works.

From the development described above, it could be concluded that:

1. The success of the programme comes from long-term cooperation between industries, universities, government offices and intermediaries;
2. The activities are driven by the industries;
3. iTAP provides managing, coordinating and supporting services;
4. There is strong leadership from the staff of TFIA;
5. Knowledge flow among members of the group is very essential; with proper knowledge, it is easier to agree upon the development steps by the members of the group;
6. The results of R&D in market, technology and trends are used to identify the direction of development of the group;

7. All activities are market oriented;
8. All activities are focused on the clients;
9. All activities are determined by industries not the experts or iTAP staff;
10. Trust is created through long-term and sincere relationship among members; and
11. A Sub-Sector Innovation Network was established.

The Sub-Sector Innovation Network starts with the formation of different groups of companies and universities or government offices, but these groups are isolated from each other. Some interactions between groups might exist but not formal and not very strong. The sub-sector is formed when there is an intermediary (such as iTAP) who brings several groups together. Innovation is created through activities like seminars, technology acquisition trips, workshop, strategic road map and public hearing.

If more Sub-Sector Innovation Networks could be established and sustained, interaction between sectors might lead to cluster formation. Some sub-sectors of raw material suppliers, standard agencies, service providers and trade associations should be established. Interactions of these related sub-sectors with wood furniture sub-sector would produce successful cluster in the future.

DISCUSSION 3

In the last session of the workshop, there was a discussion on major issues and challenges on fostering innovation through strengthening of HTCs. The discussion also aimed to clarify the role of governments. This session was co-chaired by Mr. Ha.

In Mr. Ha's view, the workshop gave a very good insight of HTCs, which was very useful and Viet Nam would benefit from the experiences of other countries. He revealed some shared concerns as follows:

- Did it matter whether the cluster was a hi-tech or low-tech?
- Was it possible to see how many provinces were successful with policies?
- How could one model developed in one area be successfully implemented elsewhere (for instance, in Viet Nam, Ho Chi Minh City policy model was not successful in other regions)?

Related to the first concern was the question: how the participants could define hi-tech and low-tech, particularly in Viet Nam. Mr. Ha put forth a definition of hi-tech; but there was no quantitative definition, and "hi-tech" depended on many factors. Although hi-tech sectors are in contrast with low-tech sectors, even low-tech sectors could apply hi-tech technologies (e.g. furniture). Mr. Mogyorosi mentioned the European Union model for regional policy: each region has to analyse competencies, weaknesses, etc. He pointed out that although regional policies could not be copied, the methodology could be and the content must be specific for the region.

Another question was about the origin of the term 'hi-tech cluster', and whether there was at all a need for the term. It was pointed out that the definition of 'hi-tech cluster' was anything but precise. The available definition originates from R&D expenditure. If it was more than 10 per cent the industry, then it was considered low-tech. If it was about 10 per cent, it was medium and if it was less that 10 per cent, the industry was hi-tech. Similarly, in a cluster, the number of members was not specified. However, in case of three members, it was cooperation; with 10 members, it was a network; and above 20 members, one could speak about a cluster. There were huge clusters with over 1,000 members. But the definition of 'hi-tech cluster' always depended on several factors.

Mr. Lee pointed out the concept that if one wanted to use a very large company like Samsung as a vehicle, then one needed to develop the companies to be able to qualify as suppliers of Samsung. If Vietnamese could provide better or cheaper products than the Korean suppliers, then they could be the basis of a cluster. In this regard, Mr. Mogyorosi gave an example of the Hungarian automotive industry where the local companies improved their technology and created a supplier network, which later became a cluster (Box 3.2).

Box 3.2: Pannon Automotive Cluster (PANAC)

The automotive sector is one of the most important industries in Hungary. It is highly export-oriented and dominated by foreign-owned large multinationals. However, it contains more and more innovative Hungarian SMEs that have successfully joined the international circulation of the sector. The sector is concentrated in the North Transdanubian Region. In December 2000, the Pannon Automotive Cluster (PANAC) was established as an innovative network-based cooperation of business and organizations. Now PANAC has more than 70 members, most of them Hungarian SMEs.

The mission of PANAC is:

- Promoting the production and the localization of automotive modules and systems;
- Assisting in the improvement of Hungarian-owned supplier companies to be able to produce and develop complex system and tools; and
- Developing the readiness of national researcher community to participate in automotive – and international – development projects.

For reach, it tries to foster the ability of Hungarian suppliers to latch on to the global supplier chains by supporting partners to reach the capability to produce high-quality and more complex products with high added value to improve their position in the supplier chain, making the network and its members more internationalized.

(Source: http://www.panac.hu)

CONCLUSIONS

Mr. Ramanathan summarized the questions and issues raised and deliberated at the workshop:

- What was the difference between HTC, industrial cluster, hi-tech park, etc.?
- How did innovation systems (national, regional and sectoral) relate to HTC development?
- How did HTCs evolve? Were they stimulated by governmental invention or organic cluster development?
- How did HTCs impact socio-economic life?
- How were HTCs measured?
- How did policy measures influence on hi-tech development?
- What were the best practices for HTC development?

At the end of the workshop, Mr. Ramanathan thanked all the speakers and participants for the cooperation and MOST in hosting the workshop.

ANNEXES

I. LIST OF PARTICIPANTS

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Mr. Mai Ha, President, National Institute for Science and Technology Policy and Strategy (NISTPASS)

Mr. Nguyen Thanh Tung, National Institute for Science and Technology Policy and Strategy (NISTPASS)

Mr. Tran Ngoc Ca, National Institute for Science and Technology Policy and Strategy (NISTPASS

Mr. Chuc Thuc Dat, Ministry of Science and Technology

Besides the above, over 40 senior officials from the government, R&D institutions and SMEs participated.

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II. PROGRAMME

Monday, 9 November 2009

08.30 - 09.00 Registration of participants

09.00 - 10.00 Inaugural Session

- Welcome Address by Mr. Mai Ha, President, NISTPASS, Viet Nam
- Opening Statement by Dr. K. Ramanathan, Head, APCTT-ESCAP, India
- Introduction of the Workshop by Mr. Nguyen Thanh Tung, NISTPASS, Viet Nam

10.00 - 10.10 Coffee break

10.10 - 11.30 Session I: Hi-Tech Clusters and Systems of Innovation

(Chairperson: Mr. Tran Ngoc Ca, NISTPASS, National Council for Science and Technology Policy, Viet Nam)

10.10 - 10.30 Open Innovation: The emerging approach for Hi-Tech Development
Mr. K. Ramanathan, Head, APCTT-ESCAP

10.30 - 10. 50 Promoting National Innovation Systems (NIS): Salient features
Mr. N. Srinivasan, Innovation Management, APCTT-ESCAP, India

10.50 - 11.30 Hi-Tech Cluster in NIS: Macro Factors for Consideration to Develop a National Policy Framework
Mr. Peter Mogyorosi, Director, Laser Consult, Hungary

11:30 - 12:10 Agglomeration and Development of Industrial Clusters in Viet Nam
Mr. Truong Chi, BINH, Institute for Industry Policy and Strategy (IPSI), Ministry of Industry and Trade (MOIT), Viet Nam

12:10 - 12.30 Discussion

12.30 - 13.30 Coffee Break

13.30 - 15.00 Session II: Development and Management of Hi-Tech Clusters: Experiences, Lessons and Best Practices

(Chairperson: Mr. K. Ramanathan, Head, APCTT-ESCAP)

13.30 - 14.10 Korea Regional Innovation Strategies
Mr. Jeong Hyop Lee, Science & Technology Policy Institute (STEPI), Seoul, Republic of Korea

14.10 - 14.45 Development of Hard Disk Drive Cluster in Thailand
Mr. Somchai Chatratana, Deputy Director, Technology Management Centre, National Science and Technology Development Agency (NSTDA), Ministry of Science and Technology, Bangkok, Thailand

14.45 - 15.00 Discussion

15:00 - 15:30 Coffee break

15.30 - 17.00 Session II (continued)

15.30 - 16.00 New Issues in Hi-Tech Cluster Analysis
Mr. Peter Mogyorosi, Director, Laser Consult, Hungary

16.00 - 16.45 Key Issues and Best Practices in Cluster Development
- Mr. Jeong Hyop Lee, STEPI, Republic of Korea
- Mr. Somchai Chatratana, NSTDA, Thailand

16.45 - 17.00 Discussion

Tuesday, 10 November 2009

09.00 - 10.30 Session III: Role of National Government and International Agencies in Facilitating Cluster Development
(Chairperson: Mr. N. Srinivasan, APCTT-ESCAP)

09.00 - 09.30 Innovation Clusters in a Developmental State Model Country
Mr. Jeong Hyop Lee, STEPI, Republic of Korea

09.30 - 10.00 Development of Sub-Sector Innovation Network in Furniture Industry
Mr. Somchai Chatratana, NSTDA, Thailand

10:00 - 10:30 Hi-Tech Development in the Key Regional Economic Regions of Viet Nam: Initial Observation and Experience
Mr. Chuc Thuc Dat, Ministry of Science and Technology, Viet Nam

10.30 - 10.45 Coffee break

10.45 - 12.30 Session IV: Conclusions and Recommendations
(Chairperson: Mr. K. Ramanathan, Head, APCTT-ESCAP)

- Discussion on major issues and challenges on fostering innovation through strengthening of hi-tech clusters
- Summary of major recommendations
- Closing remarks
  Mr. K. Ramanathan, Head, APCTT-ESCAP
  Mr. Mai Ha, President, NISTPASS