East Asia Innovation System: Collaboration and Fusion

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Abstract

The aim of this presentation is to offer an intellectual basis for the discussion on the development of East Asia Innovation System. At first, we introduce a brief history of National Innovation System in Japan. Then, we present an academic landscape of innovation research. And finally, plausible scenario for East Asian Innovation System is discussed.

I. Introduction

The presence of East Asia in global economy is increasing, and the region is becoming the global center of science and engineering as evidenced by growing share of outputs such as scientific papers and patents, while the region retains some problems in energy, food, water security and increasing aging population combined with the diminishing number of children. It is, therefore, an urgent issue for us to discuss the social issues, to share the vision of our region, and to establish East Asia Innovation System (EAIS) to realize the vision through collaborative technological, business, and social innovation.

The aim of this presentation is to offer an intellectual base for the discourse on EAIS. At first, a brief history of National Innovation System (NIS) in Japan is illustrated. Secondly, we depicted an academic landscape of innovation research. And finally, comparing the above two, we discuss the EAIS and the role of East Asia Innovation Conference (EAIC).

II. Historical perspective of National Innovation System in Japan

Figure 1 shows a brief chronology of Japanese industrial policy. The focus of Japanese NIS shifted from organization, technology, to innovation fundamentals. During 1950's, the government founded organizations that were responsible for science and engineering such as Agency of Industrial Science and Technology (AIST), and Science and Technology Agency. After launching those organizations, they developed a system such as Act of Research Association and National Project System so that the organizations can work. After the first period in 50's and 60's when

Japanese NIS launched, big projects such as Super LSI, Sunshine, Moonlight were started. These projects aim not to deepen scientific understandings on the devices and physics underlying them but to develop industrial applications such as LSI and solar cells. In 1980's, some Japanese products gained the highest global market share, and as a result, Japan experienced economic prosperity. But on the same time, Japan was criticized as it freely rides on the fruitful outcome of basic science conducted by Western countries. Reflecting such a criticism, Japanese industrial policy shifted from applied research to basic science. We can also see the same trend in industry where a number of firms established central research centers in this period. But during 90's, Japan became a serious recession which continued during the decade. This long recession is called as the Lost Decade. In late 1990's, the government started to reconstruct the innovation system. Science and Technology Basic Plans was designed, and technology license officer (TLO) was established. Those movements were influenced by proactive patent policy by U.S.A. as can be seen in Bayh-Dole Act. In early 2000's, national universities and public research institute were incorporated. And recently, manifests such as New Economic Growth Strategy and Innovation 25 were published.

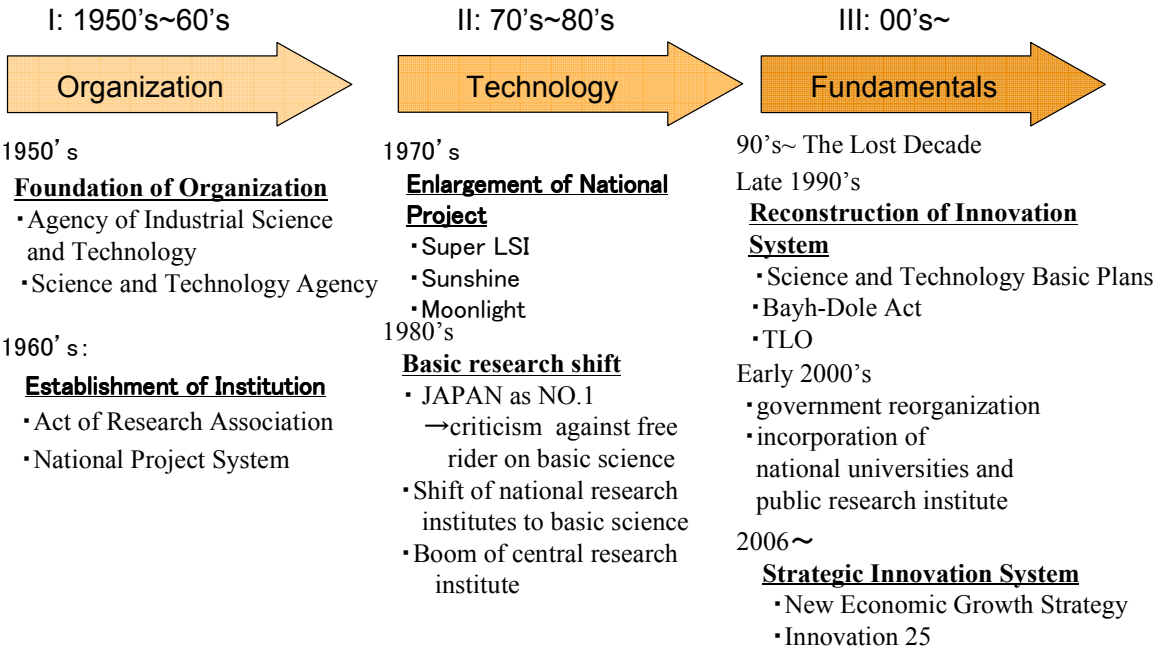

Figure 1. Chronology of National Innovation System in Japan

III. Academic Landscape of Innovation Research

In the following, we analyzed global structure of innovation research. Fig. 2 shows the number of papers of innovation research. It drastically increases after 1990. Currently, we have about 200 papers annually about innovation. In order to analyze the detailed structures, we performed citation

network analysis: a network consisting of papers and citations among them are constructed, and then it is divided into clusters where papers are densely connected by citations from papers belonging to the same cluster by topological clustering method. Clustered network is visualized in a manner that links, i.e., citations, in the same cluster are visualized in the same color. The details are shown in our paper [1].

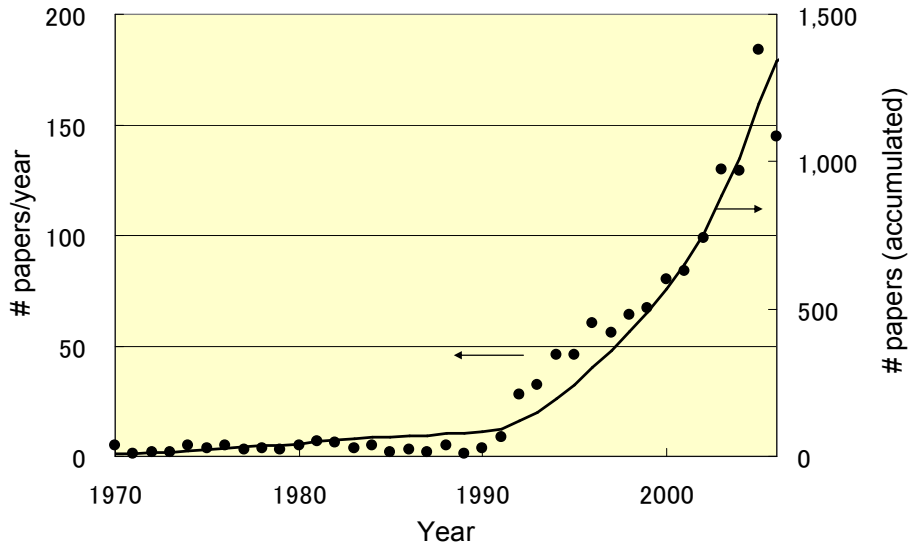

Fig. 2. Number of papers of innovation research

Figure 3 shows the visualized result of our analysis. In the figure, we show the cluster number in the order of cluster size, average year of papers in the cluster after publication, keywords discussed in the cluster. We can see three large clusters. These three clusters were recursively clustered. The results of recursive clustering are summarized in Table 1, where the characteristics of subclusters are shown. The largest cluster is Innovation Fundamentals (cluster #1), where region, university, patent are key research topics. The second largest cluster is Technological Management (cluster #2), where technology, knowledge, product are the main research topics. The cluster #2 is the youngest among the three clusters. The third largest cluster is Innovative Organization (cluster #3), where adoption, market, leadership, communication are the key concepts. The cluster #3 is the oldest among the three.

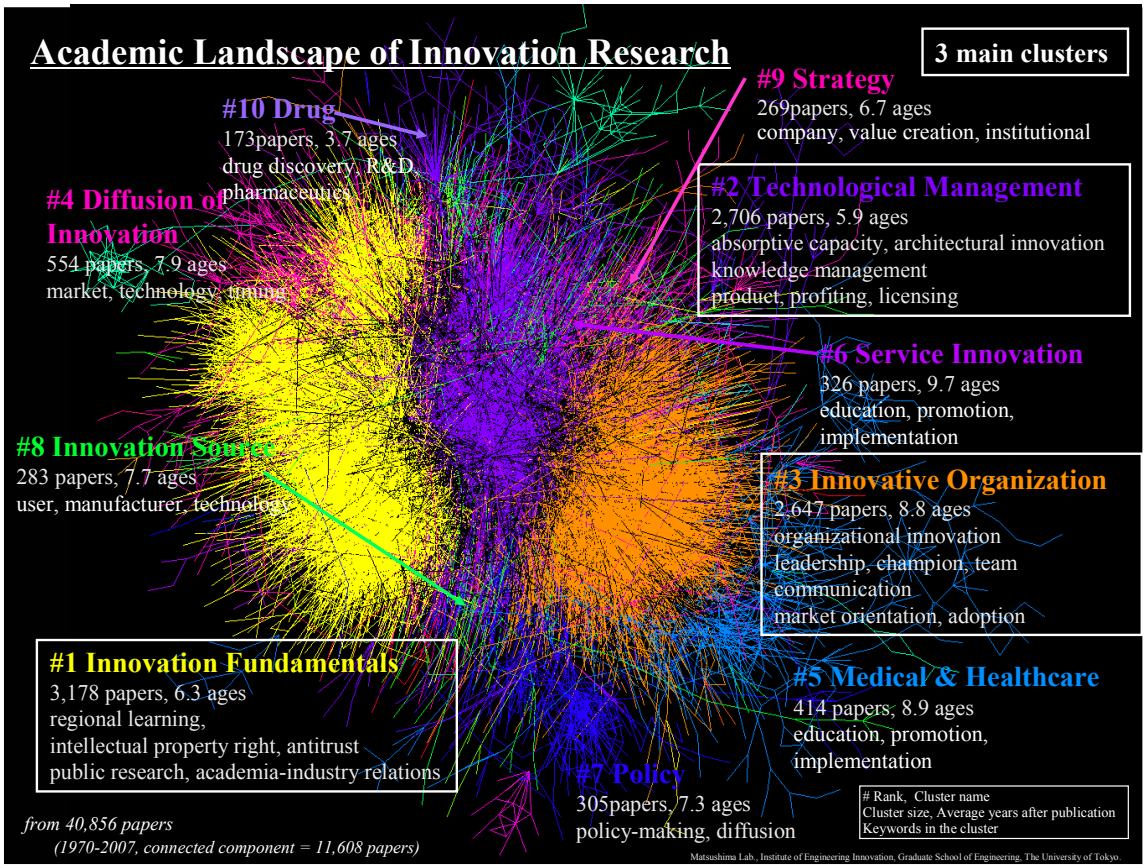

Fig. 3. Academic landscape of innovation research

Table 1. Key research topics of top 3 clusters and sub-clusters

No.	Cluster name	#Node	Year	Keywords
1.1	Regional Innovation	1132	2000.6	regional. local, network, geographic
1.2	Academia-Industry Relations	741	2000.5	public research, science, university, academia
1.3	Intellectual Property Right	701	2000.0	patent, intellectual property right, antitrust
1.4	Economic Growth	475	2000.6	growth, international trade, Schumpeterian
2.1	Industry and Technology	889	1999.9	firm, industry, technology
2.2	Knowledge Management	814	2001.7	knowledge, management, strategy
2.3	Product development	664	2001.5	product innovation, product development
2.4	Network	359	2000.4	network, inter-organization
3.1	Organizational Innovation	776	1998.0	organizational, adoption
3.2	Market orientation	540	1998.1	customer, market orientation
3.3	Leadership	522	19992	leadership, individual, group, team, behavior
3.4	Communication	249	1996.3	communication, implementation

IV. Toward East Asia Innovation System

The academic landscape of innovation research brings us interesting implications. One is the time lag of Japanese innovation policy compared to the global academic trend. In Japan, the innovation policy focuses on technological facet during 80's as shown in Fig. 1, and basic science is emphasized especially after the criticism by the Western countries. Institutional perspective such as debates on academia-industrial relations and patent policy is lacked, and we must wait TLO till the end of 90's. But in academic research, technological and institutional perspectives are co-developed from the early 90's. This delay should be partly attributed to researchers of innovation research, but the network among academia and policy makers is also lacked, which is the hurdle to disseminate the information from the cutting-edge innovation research to them.

Another interesting implications is the most visible research cluster at the level of subcluster whose size is the largest is regional innovation system. Therefore, we should set the research priority to it. As presented by Sakata in this conference, competitive region consists of competitive autonomous individuals and dense networks among them. And such regional clusters are expected to have competitive advantage through the following two channels; increase of productivity and stimulation of innovation. Increase of productivity is caused by cost reduction in transportation, access to information, technology, public goods, talents. Innovation is expected to be stimulated by various factors; competition and collaboration, usage of high quality seeds and comprehension of high quality needs, interactive feedback between needs and seeds, learning region, existence of "Ba" in this region.

Considering the current presence of East Asia in global economy and expected future role of this region, we reach the time when we must discuss EAIS. As discussed above, even in the current global economy, the importance of physical proximity and local factor is not lost. The fact is opposite: local factors shown in Fig. 4 are the only resources for us to gain competitive advantage in global economy.

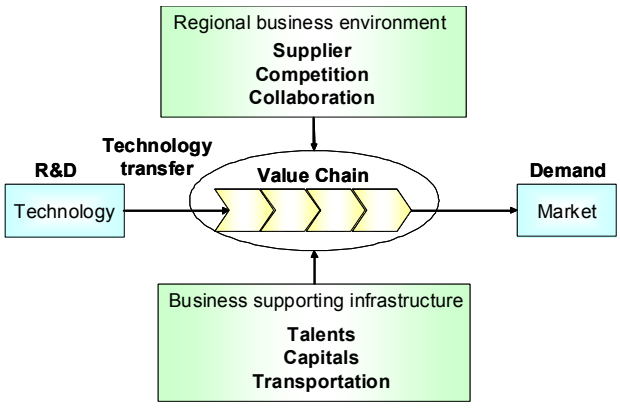

Fig. 4. Factors influencing regional advantage.

Cluster is defined as geographic concentrations of interconnected companies and institutions in a particular field. The key is network among organizations and humans. In East Asia, production is already networked. Many Japanese manufacturing companies have factories in Asia and utilize suppliers in that region. But in order to enforce EAIS and reinforce the capability in our region, we should be more proactive.

One approach reinforcing the regional capability is nutrition of talents in the region. It is well known that educated Asian students drain to U.S.A., which is called as brain drain. On the other hand, U.S.A. gains brain which contributes to its R&D activities, scientific outputs, entrepreneurships, and economic prosperity in the region. We should our education system from brain drain, brain gain, to brain circulation within the region for accumulating regional resource based on the concept of regional cluster. Recently, Japanese government founded ¥3 billion/year for the Career Development Program for Foreign Students from Asia to create networks of knowledge and skills between Japan and Asia (Fig. 5). It is clear that East Asia is responsible for the development of Asia .This program is the first step toward brain circulation in East Asia.

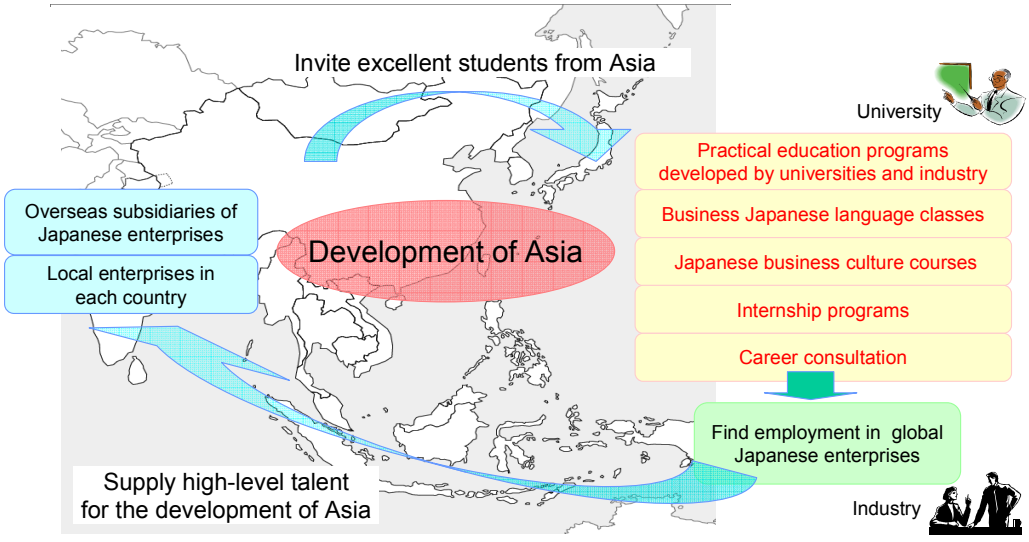

Fig. 5. From brain drain, brain gain, to brain circulation. This figure is provided by The Project Support Center for Career Development Program for Foreign Students from Asia

Another approach for the development of EAIS is project based networking. Our regions have a number of common issues such as energy, food, water security and increasing aging population combined with the diminishing number of children. These should be solved by technological, business, and social innovation. Collaborative research can contribute not only provide a solution but also enhance regional networking. Sustainability science [2,3] and gerontology are candidates to be tackled for solving the our common issues. Concerning sustainability and gerontology, each region

faces different problems. For example, Japan has faced the issue of sustainable energy supply because of the scarcity of the resource, but in Middle East, the problem differs that the problem of energy security is in international conflict. In China, the importance of sustainable water supply is increasing, and Japan is also a water deficient country considering virtual water. The concrete problems differ from country to country and region to region. In gerontology, global research focuses on medical and psychology (Fig. 6), less attention on culture adoration of Confucian value and less effort on a social system and solution. Therefore, it is worthy for us to tackle our common problem by collaborative research and to provide a solution for us. It also generates spillover effect through the development of East Asia cluster and the enforcement of capabilities In EAIS, and contributes to our society and our daily lives.

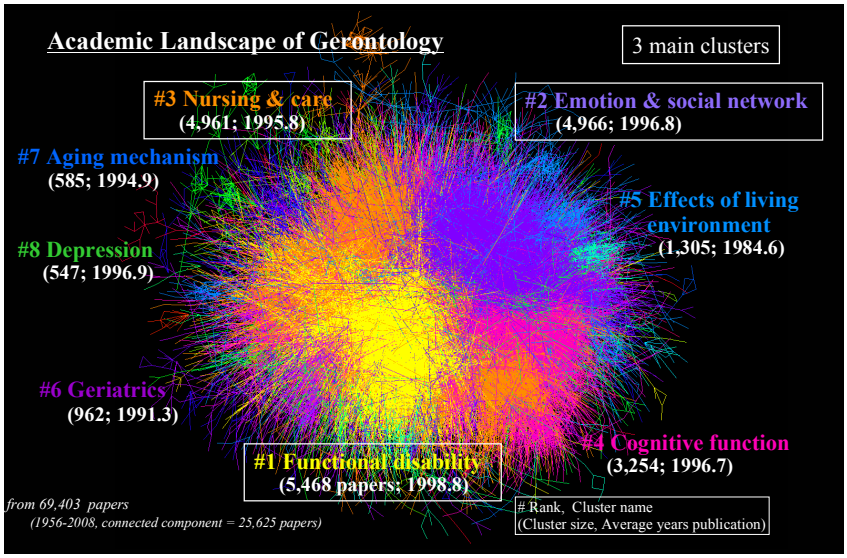

Fig. 6. Academic Landscape of Gerontology

V. Conclusion

In this presentation we offered an intellectual basis for the discussion on the development of EAIS, i.e., a brief history of NIS in Japan and academic landscape of innovation research. We also discuss general schema of regional cluster and plausible scenario for East Asian Innovation System.

At first, NIS in Japan was summarized. Its focus has shifted been from

I Organization (foundation of organization, establishment of institution),

II Technology (enlargement of national project, basic research shift),

III Fundamentals (reconstruction of innovation system, strategic innovation system).

Then, an academic landscape of innovation research was analyzed. The amount of innovation

research has drastically increased after 1990's with changing their focus from organization to technology and fundamentals.

Finally, general schema of regional cluster and plausible scenario for East Asian Innovation System were discussed. Regional cluster consisting of competitive autonomous individuals and dense networks among them fosters regional resources, enforces regional capability, and therefore increases productivity and stimulates innovation. The future role of EAIC is to work as "Ba" to realize planning of joint research on our common problems where innovation is required, poducing the cutting-edge innovation research, accelerating dissemination of the innovative seeds generated in East Asia, development and circulation of high-level human resources throughout East Asia, and promotion of mutual understanding and economic integration in East Asia.

Reference

[1] M. Hashimoto, I. Sakata, Y. Kajikawa, Y. Takeda, and K. Matsushima, Academic landscape of innovation research and innovation policy by network science, *Hitotsubashi Business Review* in press. (in Japanese).

[2] Y. Kajikawa, Research core and framework of sustainability science, *Sustainability Science* **3** (2008) 215-239.

[3] Y. Kajikawa, J. Ohno, Y. Takeda, K. Matsushima, and H. Komiyama, Creating an academic landscape of sustainability science: an analysis of the citation network, *Sustainability Science* **2** (2007) 221-231.