SCIENCEE PARKS IN JAPAN AND SWEDEN: A STUDY ON COMPARISON BETWEEN TSUKUBA SCIENCE CITY AND IDEON SCIENCE PARK

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일본과 스웨덴의 사이언스 파크 개발 전략 : 일본 츠쿠바 과학연구도시와 스웨덴 이데온 사이언스 파크에 관한 비교 연구

박 상 철

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요 약

일본의 과학공원 중 츠쿠바 과학공원의 조성과정과 그 후 이 공원의 산업체 유치과정을 보면 이 공원은 대기업의 연구소가 주를 이루고 있고 중소규모의 기업연구소의 역할을 미미한 것으로 나타나고 있다. 이 공원은 동경주변에 위치하고 있는 정부주도의 사이언스파크 개발의 전형적인 사례로 볼 수 있다. 이 공원에 있는 국가 및 공공 연구기관은 국가가 주도하는 연구개발에 촛점을 두고 있는 반면 민간기업의 연구소는 기초 및 응용기술의 개발과 동시에 이들의 사업화에 주력하고 있는 것으로 조사되고 있다.

반면 스웨덴의 Ideon 파크는 수도권에 멀리 떨어져 있는 과학공원으로 민간주도로 개발된 과학공원이다. Ideon 파크는 일본의 츠쿠바와는 달리 중소규모의 기업이 입주하여 연구개발을 활발히 수행하여 기술혁신을 주도하고 이를 사업화하는 데 성공을 거두고 있는 것으로 보고되고 있다. 이러한 점으로 인해 Ideon 파크는 역동성을 띠고 있다고 평가되고 있다.그리고 스웨덴의 Ideon 파크는 민간과 공공이 혼재되어 있지 않고, 즉 민간기업 위주로 연구개발이 주도되고 있어 철저히 상업화를 시도하고 있는 것이 특징으로 되어 있다.

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Ⅰ. Introduction

A transition from the fordistic production system based on mass production to the post fordistic production system based on small amount and various production has affected on the industrial structures in advanced industrialized nations. Additionally, a new economic order based on globalization and localization has changed fundamental economic activities. As the result, all nations are aware of the importance of technology innovation particularly in the high-tech areas that is able to create sustainable development as well as to upgrade technological capacity.

Under this circumstance, competition between nations becomes more severe than ever, and the advanced industrialized nations strongly tend to control their technology transfer to other nations in order to maintain their technological competitiveness in strategic areas(Park; 2000a,b, c).

Japan and Sweden are the late industrialized countries compared to the UK, France, Germany etc. Japan has a strong tradition that the central government carries out its industrial policies in order to upgrade its technology capacity as well as industrial structure, while Sweden has developed cooperative relationships between national and local governments, universities, and industries. The government-led industrial and technological policies enabled to launch several national projects building science parks in Japan, while the most of science parks in Sweden have been built by the initiatives of the private sectors, universities, and local governments(Park; 1999a, b, c, 2000a, b, c).

With a formation of hard competitions between nations after the new emerging economic order, high technologies became the most important factor to achieve the national and local competitiveness. Therefore, many countries strengthened their research and technology policies and invest a large amount of capital to research and development (R & D) projects. In order to carry out the R & D projects properly, they strongly tend to build the science parks(Park; 1996, 1997, 1999a, b, c, 2000b).

This paper focuses on a case study of Tsukuba Science City in Japan and Ideon Science Park in Sweden. In particular, it argues about their strategic point of views how the two science parks have been evolved and what their economic and political backgrounds are. Additionally, it is also significant questions whether they have contributed to regional development and created synergy effects or not.

Furthermore, the roles of private companies, national and local governments, universities in the science parks are analyzed.

Ⅱ. Theoretical Backgrounds

Messay and Quintas(1992) explain that traditional technology innovation model labeled as a linear model is based on a technology push model and a demand-pull model. The former focuses on basic research activity that plays a significant role in applied research, technology development, final production, and marketing continuously. In contrast, the latter insists that a market demand causes technology development, production and marketing. This means that the technology push model focuses on a supply side for R & D activity while the demand-pull model stresses a demand side of customers.

In reality, however, there is no clear distinction between the demand and supply sides during the technology innovation period. In fact, there are strong co-relationships between the two sides continuously(Park; 1999a). Therefore, Kleine & Rosenberg urges that a chain-linked model explains many aspects that the linear model cannot explain. The chain-linked model assumes that R & D activities, production and marketing play an equal role during the technology innovation period(Kleine & Rosenberg; 1986). Additionally, the operating relationships between these sectors influence not a unilateral direction, but multilateral directions including feedback functions.

In addition, Felsenstein(1994) urges that evolutionary theories of economic and technological change labeled as modern innovation theory imply broader view of the process of innovation as a technical as well as a social process Smith(1994) also urges that technology innovation is created not only from R & D activities, but also from interaction between firms and their environment, and many related activities. Therefore, he criticizes that the linear model of innovation is a part of the Fordist era of industrial organization and production, based on formal knowledge generated by R & D activity.

In order to explain the techno-economic paradigm of the post-Fordist period, Lundvall and Johnson(1994) use the concept of a learning economy based on widespread ICT(Information, Computer, Telecommunication) technologies, flexible specialization and innovation. According to this concept, knowledge is the most fundamental resources, and learning is the most important process that improves innovativeness and competitiveness.

Moreover, Asheim(1997) explains that agglomeration economies can stimulate incremental innovations through informal learning-by-doing and learning-by-using based on tacit knowledge. He also urges that an innovation of learning regions would be the establishment of territorial embedded regional systems of innovation that is called as systemic innovation and regarded as a strategic regional innovation policy. In this paper, modern innovation theory is used as a theoretical background.

Ⅲ. Science and Technology in Japan

A. Background

Since 1948, Japanese governmental and private investment in science and technology has increased in order that the government could rebuild the nation through science. Historically, science in Japan always has had a strong practical orientation, while science in Western countries has evolved over a long period. This historical background made Japanese politicians believe in the ability of science to concentrate to economic development in the 1950s and 1960s. As a result, government agencies and ministries were mainly interested in applied and developmental research rather than basic research (Dearing; 1995).

There are 21 Japanese national ministries, agencies and organizations that are involved in science and technology policies (STA; 1999). Among them, the following three government organs play a major role in carrying out science and technology policies. First, the Science and Technology Agency (STA) coordinate overall policies between ministries and agencies. At the same time, it reports directly to the Prime Minister's office and is in charge of setting up a set of research organizations in order to develop some strategic technologies. Its strategic focal points are to support basic and applied research (STA; 1999). Secondly, the Ministry of Education (MOE) mainly supports basic research in universities. Its expenditure for R & D is the largest. Finally, the Ministry of International Trade and Industry (MITI) also support basic and applied research through its Agency for Industrial Science and Technology (AIST) (Dearing; 1995, Deyda; 1995).

In order to control science and technology, the three government organizations often compete with one another intensively. It is also remarkable that factionalism has long played a role in Japanese science (Brinkman et al.; 1988, Bartholomew; 1989). These government-led science and technology organizations, particularly in the field of basic and applied research, enabled large-scale projects such as Tsukuba Science City, Kansai Science City to be set up (JICST; 1996, Kansai Research Institute; 1998). The total construction costs of Tsukuba Science City had reached about 1.8 trillion yen until 1992 (see table 1).

Table 1: The Construction Cost for Tsukuba Science City (100 mil. Yen)

	Until 1988	1989	1990	1991	1992	Total
R & D Facility	9,095	266	389	714	462	10,926
Housing for Government Officer	748	0	0	0	0	748
Construction for Residential Area	4,848	222	237	198	171	5,676
Construction for Public Facility	697	16	14	30	22	779
Fund for Tsukuba Science City	59	1	1	1	1	63
Total	15,444	505	641	943	656	18,192

Sources: LCTRAC, A Survey on Activity of Research Institutes, 1996

B. Development Process of Tsukuba Science City

A development process of Tsukuba Science City can be explained by the following three periods: planning phase in the 1960s, construction phase during the 1970s, and collaboration phase since the 1980s.

In the planning phase, to purchase lands from farmers was the most difficult barrier for carrying out the concept of the science city. The national government and landowners could not agree to use lands due to their different point of views. In order not to aggravate local farmers, the government chose an acquisition policy of "tochikukaku seiri" that shares common interests through a land readjustment procedure for combining individual landholding.[1)]

The reason for government's policy has been related to the Japanese political system. A major political supporting group for the leading politicians of Liberal Democratic Party(LDP) has been farmers so that they have had to be concerned about farmers protests against the government's land purchasing policy. The leading politicians in the ruling party influenced to the government to carry out a united land purchasing policy. As the result, the farmer could sell plots of land that were least dependent on their agriculture. It is the reason why Tsukuba Science City possesses a modified form compared to the original concept. In all, the government bought 4,446 acres of the total 6,669 acres in the education and research district from 2,600 separate farmers(Dearing; 1995).

During the construction phase, difficulties were mainly composed of two issues. The one was a bulk of complaints of researchers and their families because of insufficient infrastructures. The other was conflict between local bureaucrats to maximize their communal interests. For example, leaders of the largest town, Yatabe in the new city of Tsukuba consisting of six towns and villages were opposed to incorporated until STA promised that Yatabe would be nominated as a site of world exposition and become an industrial park after the exposition.

In March 1980, each of the 43 national research institutes was relocated and operating in Tsukuba. In spite of it, Tsukuba has suffered from a lack of innovative dynamism since private research laboratories had been virtually excluded. In Japan, the private industry has carried out 70 per cent of R & D activities and the formation of consortia and joint research associations are heavily dependent upon the private industry. Additionally, Tsukuba lacked urban amenities. Many researchers refused to live in the city although they were working there. Work-related isolation, loneliness of student's life, encouraged traditions of inter-ministry competition were typical life styles in Tsukuba.

1) Dearing explains about a land division scheme (tochikukaku seiri) as followed: It is originally adopted from Germany. The government persuades each private landowners to give up approximately 30 per cent of his or her land in exchange for a guarantee by the government that subsequent public investment in the acquired land will increase the value of the remaining privately owned land as well.

A turning point of Tsukuba Science City was the International Science and Technology Exposition in 1985 that about 20 million Japanese and foreigners visited. A senior official of STA suggested it in order to promote positive aspects of science and technology to the general public. With the Expo, Tsukuba gained a positive attention from the Japanese people and began to be recognized as a place of science after the visits of two European summits, Francois Mitterrand and Margaret Thatcher. Since then, land prices were skyrocketing and private companies invested to build R & D labs (Castells & Hall; 1994).

In addition, attempts of increasing scientific communication and research cooperation led by Kawamoto Tetsuzo had played an important role to activate collaborations between government, university and industry. Due to the lack of success of government's endeavor to form research cooperation, Mr Kawamoto Tetsuzo as the head of a private research consortium started to boost collaborations that consist of specialized group communication, and general and group communication. According to his opinion, the latter are the most desirable types of communication in future since these enable researchers to gain new insight as well as to create new interdisciplinary fields(Kawamoto; 1994).

Ⅳ. The Roles of Tsukuba Science City

A. The Roles of High-Tech oriented Private Companies in Tsukuba Science City

In Tsukuba, there are 101 research institutes in 1994 that are registered by the Liaison Council of Tsukuba Research & Academy City for Research Institutes (LCTRAC). This number increased up to 113 in 1998. Among these, 41 and 53 research institutes were operating in the same period(see table 2).

Although the private research institutes account for over 46 percents of the total institutes numbers, its men powers and annual budget are inferior to the national research institutes(see table 3, 4).

Table 2: Research Institutes in Tsukuba Science City

Research Institutes	Number(94)	Ratio(94)	Number(98)	Ratio(98)
National Research Institutes	44	43.6	44	38.9
University Research Institutes	5	4.9	4	3.5
Public Research Institutes	11	10.9	12	10.7
Private Research Institutes	41	40.6	53	46.9
Total	101	100	113	100

Sources: LCTRAC, A Survey on Activity of Research Institutes, 1996, 1999

The reasons for such a different numbers of employees between national and private research institutes are as follows: First, the national research institutes are usually large sized. In addition, the central government planned to complete its whole national research institutes until 1995 by establishing a metal and material engineering institute from STA. Therefore, the numbers of employees have increased continuously. Second, there are 17 research institutes among 53 private research institutes that have less than 30 employees. 24 research institutes among 53 private research institutes have employees between 31 and 100. These indicate that the most of private research institutes are small and medium sized research institutes(LCTRAC; 1999). It must be also pointed out that the private research institutes tend to be reorganized and down sizing due to impacts of bubble economy in the beginning of the 1990s although the total number has increased(LCTRAC; 1996, 1999).

Table 3: Numbers of Employees in Different Research Institutes

Research Institutes	1985	(%)	1994	(%)	1998	(%)
National Research Institutes	6,543	58.9	7,108	55.2	9,814	60.2
University Research Institutes	3,933	35.4	4,269	37.2	3,881	23.9
Public Research Institutes	0	0	125	0.9	688	4.2
Private Research Institutes	626	5.7	1,367	10.7	1,918	11.7
Total	11,102	100	12,868	100	16,301	100

Source: JICST, Tsukuba Science City, Annual Report, 1996; LCTRAC, Research Annual Report in Tsukuba Science City 98-99, 1999

Table 4: Annual Budget of Different Research Institutes (1 mil. Yen)

Research Institutes	1985	(%)	1994	(%)	1998	(%)
National Research Institutes	58,545	41.3	94,327	47.1	399,397	82.9
University Research Institutes	74,270	52.5	86,076	43.0	59,498	12.3
Public Research Institutes	80	0	1,795	0.9	12,548	2.7
Private Research Institutes	8,694	6.2	1,7888	8.3	10.382*	2.1*
Total	59,675	100	200,086	100	481,825	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996, LCTRAC, Research Annual Report in Tsukuba Science City 98-99, 1999

Note*: 43 private research institutes among 53 did not provide their annual budget. In fact, the total amount of annual budget of private research institutes in 1998 must be much higher than this number[2].

2) This latest statistical materials are provided by Mr. Nobuyoshi Yamao at Information Center for Science and Technology, Japan Science and Technology Corporation on 5th Dec. 2000 when I and

Domestic joint research activities have increased dramatically. The total number of joint research in the private research institutes is superior to the total number of joint research in the national research institutes. However, international joint research activities are in reversed situation. It indicates that the national research institutes focus on international joint research while the private research institutes prefer to domestic joint research(see table 5 & 6).

Table 5: Domestic Joint Research

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	0	0	14	70	41	41.4
University Research Institutes	0	0	1	5	12	12.1
Public Research Institutes	0	0	1	5	3	3.0
Private Research Institutes	0	0	4	20	43	43.5
Total	0	0	20	100	99	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996

Table 6: International Joint Research

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	8	100	36	90	197	86.8
University Research Institutes	0	0	4	10	22	9.7
Public Research Institutes	0	0	0	0	0	0
Private Research Institutes	0	0	0	0	8	3.5
Total	8	100	40	100	227	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996

In terms of research papers, the national and university research institutes publish vigorous academic papers, while the private research institutes seem to be less active (see table 7).

The national and private research institutes have carried out very active domestic patent enrollments. However, the national research institutes are stronger than the private research institutes in an international patent enrollment. It shows that the national research institutes have a strong capability to implement their research results in the international patents(see table 8 & 9).

Asistant Prof. Hironobu Oda carried out our research field work on the same day.

Table 7: Publication of Research Paper

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	7,532	92.6	13,727	86.0	20,541	81.1
University Research Institutes	522	6.4	2,063	12.9	3,046	2.1
Public Research Institutes	0	0	8	0	126	0.5
Private Research Institutes	76	1.0	158	1.1	1,594	6.3
Total	8,130	100	15,956	100	25,317	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996

Table 8: Domestic Patent Enrollments

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	909	79.1	1,553	67.8	3,233	63.7
University Research Institutes	1	0	19	0.8	30	0.6
Public Research Institutes	0	0	0	0	0	0
Private Research Institutes	239	20.9	718	31.4	1,812	35.7
Total	1,149	100	2,290	100	5,075	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996.

Technology transfers of the research institutes have increased continuously. However, technology transfers of the private research institutes are still weak compared to the national research institutes. It means that owners of the private research institutes strategy tend to keep the results of their research for themselves(see table 10).

Table 9: International Patent enrollments

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	117	84.2	306	86.4	695	68.6
University Research Institutes	1	0.7	7	2.0	6	0.6
Public Research Institutes	0	0	0	0	0	0
Private Research Institutes	21	15.1	41	11.6	284	30.8
Total	139	100	354	100	925	100

Source: LCTRAC, A survey on Activity of Research Institutes, 1996

Table 10: Technology Transfers

Research Institutes	1975	(%)	1985	(%)	1994	(%)
National Research Institutes	1,791	98.4	2,638	92.0	2,515	81.8
University Research Institutes	0	0	0	0	73	2.4
Public Research Institutes	0	0	0	0	1	0
Private Research Institutes	30	1.6	232	8.0	486	15.8
Total	1,821	100	2,870	100	3,075	100

Source: LCTRAC, A Survey on Activity of Research Institutes, 1996

In sum, although the roles of high-tech oriented private companies in Tsukuba Science City have increased continuously, particularly in domestic and international patent enrollments and technology transfers, their capability is still limited. There are several reasons for that.

First, Tsukuba Science City has government-led large sized research institutes that focus on major national research projects.

Second, Japanese major private companies still prefer to locate their research institutes in Tokyo.

Third, among 53 private research institutes, there are 17 research institutes with less than 30 employees and 24 research institutes with less than 100 employees. The number of large sized private research institutes with over 100 employees is only 12. It means that the major private research institutes are small and medium sized.

B. The Role of Tsukuba Science City in Regional Development

The Tsukuba project is a large-scale economic development that is common in Japan. Its development cost accounted for more than 1.8 trillion yen until 1992. In Japan, a common process of regional economic development is carried out as follow: A prefecture government suggests a project to develop its region. After the national government accepts the project, the prefecture government publicizes its idea and holds a massive event to promote a new area. Private industry and general public begin to pay attention to the place because of mass media's reports. The new area perceives a good investment opportunity. This sequence of economic planning and development are Senri New Town for the 1970 Osaka Fair, Kobe Port Island 1981, Tsukuba Expo 1985, Yokohama Exotic showcase 1989 etc.

The concept of Tsukuba Science City, however, possesses a dualistic character as a national plan to develop future oriented science and a capital region development plan to solve exceeded agglomeration problems in Tokyo metropolitan areas. Tsukuba as a new science city has been developed dramatically although there are some critical points of view on its development stages due to its vast capital expenditures.

In physical term, the city possesses approximately 188,000 peoples as of April 2000. Among them, the research and academic district has about 65,000 populations. In this district, about 10,000 researchers are working that is a same scale of Akademgorodok and Silicon Valley(JICST; 1996, Kawamoto; 1994, www.info-tsukuba.org/2000).

In spite of such a physical development, Tsukuba still lacks industrial spin-off and synergy effects although there are 8 industry and research parks in Tsukuba Science City (Research Exchange Center;2000)[3]. Political support creating tax revenues and employment as well as supply of labor are in general the most important factors to improve industrial development. Tsukuba has always gained political supports from the national and local governments. However, a supply of labor has been always a chronic problem because high technology oriented industry needs highly qualified men powers such as managers and engineers. Moreover, a supply of engineers having independent mind is little compared to the United States. It means that to accumulate scientific and research resources would take long time(Rogers & Larsen; 1984, Gibson & Dearing; 1988).

In addition, many private companies refused to locate in Tsukuba due to its lack of production facilities, subcontractors, marketing expertise etc. although the number of private companies has been increased after Tsukuba Expo 1985. For example, the National Space Agency relocated in Tsukuba contracts all manufacturing to the private sector. All manufacturing firms are located in Yokohama and Kanagawa for satellites and Nagoya for rockets. Even in the design stage there was no pulling the manufactures to Tsukuba because the main operations for the Agency are controlled by STA in Tokyo (Dearing; 1995, Castells & Hall; 1994).

As other reason for weak synergy between government, university, and private industry as well as insufficient industrial spin-off effects from basic and applied research, their research activity was a lack of competition with industry. In the middle of the 1980s, the government and industry put their priority on basic research. For example, Electro-technical Laboratory has developed its linkage with private companies. It is also remarkable that the government cuts its staff numbers systematically every year. It aims that the private sector can absorb the highly qualified researchers on the one hand and critical scientific information and technology are transferred on the other. A problem of the system is that no private companies would compensate shrunk staffs of uninterested public institutions. Generally, they prefer the MITI-governed institutions and its compensation is based on economic calculation at first hand (Castells & Hall; 1994).

In sum, although Tsukuba obtains some problems to attract high-tech industry, its physical

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3) Miss Yuriko Nakayama at Research Exchange Center, Science and Technology Agency delivered me valuable statistical materials about industry and research park in Tsukuba Science City on 23rd Oct. 2000. Additionally, the latest statistics on domestic joint research, international joint research, publication of research paper, domestic patent enrollment, international patent enrollment, technology transfer are not carried out precisely.

development continues(Onda; 1988). Following Tsukuba Expo 85, the occupancy of land had been rapidly increased due to the investment of private sectors. At present, only the Expo area is available that will go to the private industry. Therefore, the Land Restructuring Agency needs to provide more lands for late coming institutes.

Tsukuba will continue to develop on the basis of its basic and applied research activity that can create synergy and industrial spin-off effects in the long run. Moreover, the whole population of Tsukuba is expected to double to 320,000 after the construction on the New Joban Line, a new 60 kilometer high-speed train line, from Tokyo to Tsukuba planned to be completed by 2005.

With the new train line Tsukuba and 15 surrounding cities, towns and villages, and Ken-o Do, Metropolitan Inner City Expressway will have 1 million population that the architecture of Tsukuba Science City, Kono Ichiro planned to build a 1 million population city in the Northern Kanto Plain for industrial development in the 1960s. (Dearing; 1995) Additionally, the Tsukuba Science City Area Development Plan and the Surrounding Area Development were revised in July 1996. With the revision, Tsukuba Science City aims to become the center of scientific research, self-sufficient core city and an eco-life model city(www.info-tsukuba.org/2000).

V. Ideon Science Park in Sweden

A. Background

Sweden as a highly advanced industrialized nation does not have a long historical background in terms of industrial development. Similar to Japan, Swedish industries began to develop in the end of 19th centuries.

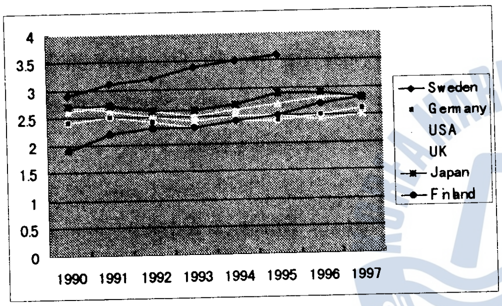
For a rapid industrial development, the central government built two technology colleges such as Royal Institute of Technology in Stockholm and Chalmers Institute of Technology in Gothenburg in 1870 and 1871 respectively. These colleges have had a strong tradition of cooperation with industries(Solvell et. al; 1991).

Swedish industries have been developed on the basis of a bulk of natural resources such as forest, tungsten, iron etc. as well as social and economic needs such as transport, telecommunication etc. Although Sweden is a small nation with 8.9 million populations, all industries have developed in balanced.

However, some conventional industrial sectors such as shipbuilding industry, automobile industry, steel industry etc faced to a severe competition in the world market since the 1970s, while future industrial sectors such as telecommunication industry, biotech industry obtain a strong comparative competitiveness. Therefore, Sweden is keen to focus on the future industrial sectors(Barnevik; 1995).

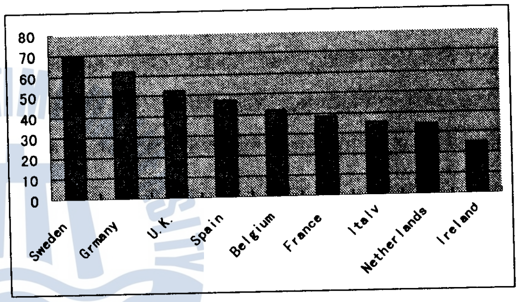
NUTEK (Agency for Industry and Technology Development) is responsible for science and technology policy in Sweden. NUTEK is a government agency and dealing with science and technology policy, innovation policy, and regional development[4]. It also creates proper R & D environment for industries to become competitive. Therefore, NUTEK stimulates collaborations between industry, university and research institute. It also supports international cooperation particularly within the European Union (EU) (www. nutek.se; 2000).

Sweden invests over 3.5% of its GDP to the R & D sector that is the highest level among the OECD member nations(see fig. 1) (ISA; 1998, Park; 1999). It is also pointed out that many Japanese R & D facilities are located in Sweden. About 70% of the Japanese-owned manufacturing companies in Sweden perform local R & D activity that is the highest ratio in Europe (see fig. 2) (ISA; 1998).



Source: OECD, Main Science and Technology Indicators, 1997, The Science and Technology Policy Council of Finland, 1999.

Figure 1: R & D Investment of GDP in Major Advanced Industrialized Nations (%)



Sources: JETRO, The 13th Survey of European Operation of Japanese Companies in the Manufacturing Sectors, 1997, ISA, Invest in Sweden Science Parks, 1998

Figure 2: R & D Facilities in Japanese Manufacturing Affiliates in Europe (%)

B. Development Process of Ideon Science Park

Ideon Science Park is one of the oldest science parks in Northern Europe. It started to be built by the initiatives of Skone local government, Lund University and Lund Institute of Technology in 1983.

A main motive to create Ideon Science Park was that the local industrial structure in the southern part of Sweden, Skone based on heavy industry and textile industry faced a restructuring process focused on IT industry as well as biotechnology.

A basic idea of Ideon Science Park is to use all scientific and technological abilities existing at universities and industries in Lund area and to realize these into commercialization(Ideon Center AB; 2000).

4) NUTEK is an initial of Naerings- och teknikutvecklingsverket.

The two private land developers such as Forsta Fastighetsbolaget, Ideon AB have mainly financed to build Ideon Science Park. These real estate companies bought 114,000m2 land in Polsjo and built 50,000m2 offices and laboratories such as Kuvosen, Alfa, Beta and Gamma from 1983 to 1987. These have been expanded continuously and built an extra site with 20,000m2 in the year 2000(Ideon Science Park; 2000, Idoen Info, May 2000).

Ideon Science Park is located in the proximity of highly qualified two universities. The local government and Lund community are also keen to cooperate with Ideon Science Park for economic and technological development in their region. Additionally, the above two real estate companies strongly believe in a rapid development of Ideon Science Park. Such a strong collaboration between various actors is a major factor for a successful result of Ideon Science Park.

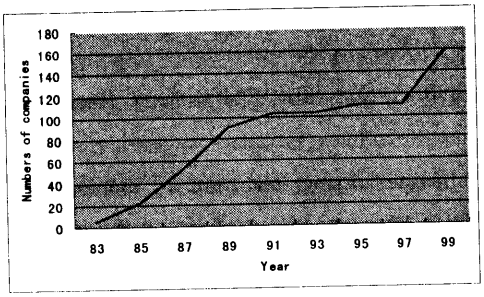
In September 1983, 5 companies moved in Ideon Science Park. Since then, almost 400 companies have carried out their R & D activities. In 1999, there were 160 companies operating in Ideon Science Park, and about 1,500 employees were working(see fig. 3). In the year 2000, there are 170 companies, and about 30 companies are directly linked to Idoen Science Park. Including these companies there are about 6,000 employees working for the park.

C. The Roles of High-Tech oriented Private Companies in Ideon Science Park

The 170 companies operating in Ideon Science Park are mainly small companies. Among these companies, over 90 companies have only 1-3 employees. There are only 2 companies with over 100 employees. One of these companies is Telefonaktiebolaget LM Ericsson that invented a mobile communication system in Ideon Science Park. Additionally, two medium sized companies hiring 51-100 employees are operating(see fig. 4).

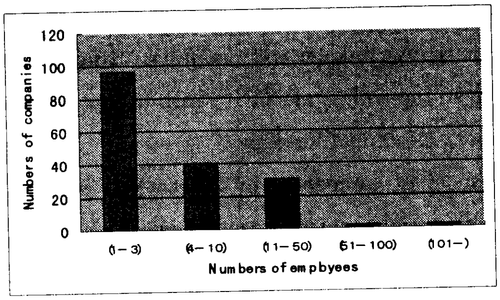
About 400 companies have operated in Ideon Science Park since 1983. 76% of these companies are linked to Lund University and Lund Institute of Technology in order to improve technology capacity as well as to create technology innovation. The private companies rushed into the park until 1989. The numbers of the companies increased up to 90 from 1983 to 1989. However, such a rapid development caused a lack of space for the companies on the one hand, and an economic crisis hindered a continuous expansion in the beginning of the 1990s on the other.

As the result, the numbers of the private companies increased only from 90 in 1989 to 110 in 1996. Among the total number of 400 companies, about 30 companies went to bankruptcy so far. In the year 1992, about 10 companies were closed due to the economic downturn. The year 1992 was the worst business year for Ideon Science Park. However, a fast recovery came between 1997 and 1997. After a renovation of Alfa house for small and medium sized companies, the numbers of companies have increased rapidly from 110 companies in 1997 to 160 companies in 1999(Ideon Center AB; 2000).



Source: Ideon Center AB, Forskningsbyn Ideon I Lund, 2000

Figure 3: Development of Ideon Science Park between 1983 and 1999

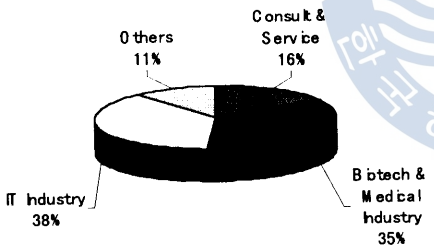


Source: Ideon Center AB, Forskningsbyn Ideon I Lund, 2000

Figure 4: The Number of Companies and Employees in Ideon Science Park

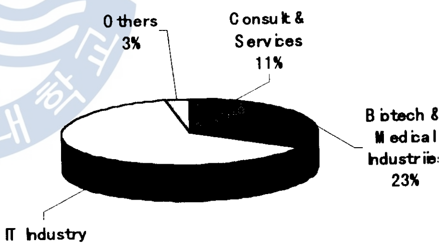
In Ideon Science Park, biotechnology and medical science have been dominated since 1983. However, IT technology became the dominant industrial sector first time in 1999. Additionally, the numbers of employees in the IT technology are major working forces in the park(see fig. 5, 6).

As the statistics show, the small and medium sized companies with less than 100 employees are overwhelmed. It indicates that the small sized companies are a major force for Ideon Science Park to become dynamic and to create technology innovation as well as commercialization.



Source: Ideon Center AB, Forskningsbyn Ideon i Lund, 2000

Figure 5: Structure of Companies in Industrial Sectors (%)



Source: Ideon Center AB, Forskningsbyn i Lund, 2000

Figure 6: Ratio of Employees in Industrial Sectors (%)

D. Problem Analysis and Future Perspectives of Ideon Science Park

Ideon Science Park has one of the most successful results based on the numbers of the companies and employees although its historical background is relatively short compared to Silicon Valley in the USA and the Cambridge Science Park in the UK.

Nevertheless, it has the following weak points and limitations that must be improved.

First, R & D oriented activity

All of companies operating in the park can only carry out their R & D activity. These companies that do not have any access to production facilities for their test products have to obtain a strong linkage with manufacturing sector.[5)]

Second, the roles of TIC (Technology Incubation Center) and TBI (Technology Business Incubator) as main functions

The most of companies in the park is small sized companies hiring less than 10 employees. These companies are operating about 2 years long in TIC. After graduation from it these can either go to TBI another 2 years long or move out in the market directly.

Therefore, the most of companies do not operate continuously in the park in order to technology innovation further. It is safe to say that the main function of the park is to support new starting high-tech companies that enable to generate new products.

For the future strategy, Ideon Science Park is focusing on the following points:

First, to create more space for companies and employees

The park is keen to develop the area continuously and to create more space for companies and their employees.

Second, to collaborate with international partners and to find small niche companies

The park is looking for international partners to facilitate the global marketing of the products and services of small niche companies(ISA; 1998).

Ⅵ. Comparison between Tsukuba Science City and Ideon Science Park

It is useful to compare Tsukuba Science City with Ideon Science Park in order to analyze their similarities and differences that can show us real reasons for their stat and rapid development.

First of all, Tsukuba Science City and Ideon Science Park have same characters such as the first science park in their nations, the most successful case in their nations etc(see table 11).

Table 11: Same Characters between Tsukuba Science City and Ideon Science Park

Tsukuba Science City	Ideon Science Park
Most Successful Case in Japan	Most Successful Case in Sweden
First Science City in Japan	First Science Park in Sweden
Artificial Land Development	Artificial Land Development
Regional Development in Ibaraki-Ken	Regional Development in Skone

Sources: Adopted by the Author

The similarities between the two science parks are that these are mainly focusing on R & D

5) Interviewed with Birgitta Steen, manager in Ideon Center AB on 26th July 2000

activity in order to upgrade technological capacity as well as to create technology innovation on the local and national levels(see table 12).

Table 12: Similarities between Tsukuba Science City and Ideon Science Park

Tsukuba Science City	Ideon Science Park
R & D oriented Activity on the National Level	R & D oriented Activity on the Local Level
To Upgrade National Technological Capacity	To Create Technology Innovation and Commercialization
Role of R & D Center on the National Level	Role of Incubator (TIC/TBI) based on R & D

Sources: Adopted by the Author

The differences are very wide. The reason for it is that the two nations have developed different economic, political, and social systems. These factors influence even to different management styles in the two science parks(see table 13).

Table 13: Differences between Tsukuba Science City and Ideon Science Park

Tsukuba Science City	Ideon Science Park
Central Government financed National Project	Private Companies financed
Large sized Site (4,400 acre)	Medium sized Site (114,000m2)
Multiple R & D Areas (National, Public, and Private Research Institutes)	IT & Biotechnology oriented R& D
Long Development Process (since 1967)	Rapid Growth (since 1983)
National Government Initiative	Local Government Initiative
National & Local Government Support System	The 3rd Sector Support System
Weak University's Role	Strong University's Role
Located in Proximity of the Capital (60 km from Tokyo)	Located in a Remote Area (700km from Stockholm)
Inefficient Center Function -Tsukuba Research Exchange Center (STA) -Tsukuba Human Resource Information Center (Ibaraki Prefecture) -Tsukuba Research Support Center (Private) -Tsukuba Research Consortium (Private)	Efficient Center Function (Ideon Center AB)
Secluded R & D Tradition	Cooperative R & D Tradition
Weak Local Synergy and Industrial Spin-off Effects	Strong Local Synergy and Industrial Spin-off Effects

Sources: Adopted by the Author

Ⅵ. Conclusions

Tsukuba Science City demonstrates that the large-scale organization of science can be used as solution measures of various problems such as agglomeration problems, political conflicts, long-term economic development etc. As the national government announced the concept of a new science city, the host local government, Ibaraki Prefecture greeted and expected regional development since the region was relatively underdeveloped in spite of geographical proximity to Tokyo.

With a vast capital investment supported by the national and local governments as well as massive relocation of national and public research institutes, Tsukuba has developed continuously. However, due to its original plan as a part of capital region development Tsukuba's dependency on Tokyo is still high. In particular, transportation, communication, information, and cultural sources are highly dependent on Tokyo metropolitan area although a new tendency on self-sustaining attempts in certain areas is improving.

There are many critical points of view on Tsukuba Science City since it has not created sufficient local synergy and industrial spin-off effects yet despite of the vast capital investment and strong political supports. The main arguments of critics are based on inefficient resource allocation focused on hardware-oriented investment in huge facilities as well as Tokyo metropolitan oriented regional development instead of harmonious national development.

In reality, however, the city has been rapidly developing, and communication and collaboration between government, university, and private sector have been intensified after Tsukuba Expo 85. The national government also realized a regional disparity so that it announced the concept of Technopolis in order to improve regional development based on high technology industries. It is seen that Tsukuba Science City is regarded as a national project on the one hand at the same time a capital regional development plan on the other in order to build a research center in Great Tokyo Area while the Technopolis plan is focused on regional development based on local initiatives and playing a role of research periphery. (Takeuchi; 1991)

The roles of the private companies in Tsukuba Science City have increased continuously since 1975. However, their activities are still inferior to the activities of the national research institutes in terms of joint research, patent enrollments, technology transfers etc. Compared to large sized national research institutes hiring more than 100 employees, a majority of the private research institutes is small and medium sized. It may indicate that the private research institutes attempt to absorb all kinds of benefits, such as new research information, frequent contacts with top level researchers face to face, possible technology transfers etc. in Tsukuba Science City.

Compared to Tsukuba Science City, Ideon Science Park is located in a remote area from the capital, Stockholm and have developed very rapidly although the national government did not provide any financial support.

Local initiatives based on policy and administrative supports from the local government and community, participation on private land developers, and strong R & D capacity of universities created a rapid growth of Ideon Science Park as well as a sustainable development in the region.

Over 80% of the private companies operating in Ideon Science Park are small sized companies hiring less than 10 employees. These companies create new technology innovation and succeeded in commercialization. After their successful commercialization, these enter into a market competition. Such a rapid cycle of business operation causes dynamism in Ideon Science Park

Overall, national and public research institutes in Tsukuba Science City are focusing on strategic R & D activity on the national level, while private research institutes are keen to develop the results of basic and applying R & D as well as their own R & D areas into commercialization.

However, the goal of Ideon Science Park is simplified because there are only private companies operating. It is safe to say that a created technology innovation by a private company must be succeeded in commercialization as soon as possible.

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