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The Formation of the Software and Information
Services Industry in Dalian, China

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1. Introduction

(1) The Purpose of This Study

The purpose of this paper is to elucidate the factors leading to the formation of the software and information services industry in the city of Dalian, China.

Studies on information services industries around the world acknowledge India as a center for offshore development and service outsourcing. In contrast, China's information services industry has a higher ratio of software product development targeting domestic markets (Gregory et al., 2009, Chapter 4). Dalian, however, has prospered as a hub for development and services aimed at Japanese market. While the sales volume and value of exports for the software and information services industry in Dalian were over 200 million yuan and several million dollars, respectively, in 1998, the figures exceeded 40.27 billion yuan and 1.4 billion dollars, respectively, in 2009. The export ratio is 23.8% based on the conversion to the U.S. dollar using each year's foreign exchange rate. This is significantly higher than the 13.2% export ratio of the entire Chinese software and information services industry (Figure 1). In addition, 90.9% of Dalian's exports are directed to Japan (Dalian Economic and Information Technology Committee et al., 2009), a percentage considerably greater than that for all of China, which is approximately 60% (Department of Software and Services Industry, Ministry of Industry and Information Technology of the People's Republic of China, et al., 2010). This indicates that Dalian's software and information industry vastly differs from the general picture of the same industry in China, suggesting it needs to be analyzed separately as an offshore service center for Japanese markets.



Figure 1: Breakdown of markets for the software and information services industries of Dalian and China, 2009

Source: Created by the authors based on information obtained from the Dalian Economic and Information Technology Committee and Dalian Software Industry Association (2009).

Research on China's information services industry is generally conducted under the umbrella of IT industry research (e.g., Nakagawa 2007); therefore, it is slightly behind the research on IT-related manufacturing industries. Even when studies clearly target the information industry, they tend to focus more on cases involving Beijing and Shanghai; Dalian is often considered to be just one example among other cities, even in offshore development studies (e.g., Umezawa 2007, Xu 2008, Kondo 2009, Takahashi 2009). Only a few limited prior studies, such as those by the Organization for Small & Medium Enterprises and Regional Innovation, Japan, Business Support Information Center (2007), Tajima (2008), Inoue (2009), and Zhao et al. (2009) have detailed characteristics of Dalian as an offshore service center for the Japanese market. However, even these studies do not discuss the process of industry formation in great detail. They do not clarify why Dalian was able to become an offshore service center for the Japanese market or why it did not develop in any other way. To this end, Habuchi (2010) proposed the interesting hypothesis that Dalian was forced to become an offshore development center because the city lost talented human resources to Beijing and Shanghai. However, there is not sufficient empirical evidence to prove this hypothesis, and, in particular, his assertion that Dalian lacks an adequate number of workers returning to the city from overseas is questionable.

Katoku (2005) and Gao (2008) touched on the process of industry formation in their books published for the general public. The latter is an extremely significant prior study since it contains a large collection of valuable testimonials by parties involved in the industry's formation. However, both sources are written as business books for a general audience and contain only a few academic analyses. Therefore, it seems there is value in analyzing the software and information services industry in Dalian separately by looking back its formation process.

(2) Analytical Viewpoints

Based on the factor endowment theory, the information services industry, a knowledge-intensive, high-tech industry, does not develop easily in developing or emerging economies. However, the industry is actually growing rapidly in several emerging nations, hastening the work in field of economics and business administration to explain this phenomenon. One of the promising explanations is the "brain circulation" theory proposed by Saxenian (2004, 2006, 2008). Saxenian demonstrated cases in which elites from countries such as China, India, and Taiwan learned about technology and entrepreneurial cultures in Silicon Valley and subsequently made significant contributions to industry formations by returning to their countries to start businesses or to lead business projects pursued by multinational corporations. However, although Saxenian acknowledges the profound effects of this brain circulation in India and Taiwan, she argues that it is not necessarily the case in China, emphasizing instead that there are issues with the entrepreneurial environment, such as strong government intervention, which limit the effect of brain circulation. However, she fails to look at the uniqueness of Dalian and its relationship with Japan. Gregory et al. (2009) reveal survey results indicating that software companies in China have fewer employees or management personnel with experience studying abroad or working overseas than companies in India. However, because samples for China were limited to Beijing, Shanghai, and Guangdong Province, the study does not reflect the

characteristics of Dalian.

One of the working hypotheses to be examined in this paper is that the effect of brain circulation with Japan is at work in Dalian. However, the formation process of the software and information services industry in Dalian was also part of China's transition to a market-oriented economy in which enterprises emerged from various sources, including government agencies, state-owned enterprises, and universities. Therefore, we should expect that entrepreneurs might emerge from circumstances other than brain circulation. In addition, China's local governments have been deeply involved in the industry-formation process. On the one hand, it involved liberalization toward marketization, but, on the other hand, it meant aggressive government intervention in markets using tactics such as subsidies and preferential tax treatment. Thus, it is necessary to evaluate the relationship between local government policies and industry formation. In addition, whether factors oriented toward offshore services for the Japanese market also existed in the entrepreneurs' background and trends in government activities in the case of Dalian must be examined.

As explained above, the software and information services industry in Dalian has unique characteristics, but its formation process has not been explained. Although the brain circulation theory can offer valuable insights for analyzing this formation process, it is necessary to take the transition to a market economy in China and the relationship with Japan into consideration and examine entrepreneurs' background and the role of governments from more diversified perspectives. To sum up, we believe that this paper can provide unique value in terms of the target subject and viewpoints.¹

2. Formulation of Promotion Policies for the Software and Information Services Industry

(1) Dalian and the "Northeast Phenomenon" in Old Industrial Bases

With abundant underground resources such as petroleum and coal as its backbone, during the era of planned economy, the northeast region² played a central role in industrial production as a cluster of state-owned enterprises with roles in the heavy and chemical industries, such as electric power, machinery, chemicals, iron and steel, and shipbuilding. However, as Sino-Soviet relations deteriorated, the priority for national investment was redirected to the south, making issues such as aged facilities and equipment more serious. In addition, having deteriorated heavy industries with poor adaptability militated against the region after the Chinese economic reform in 1978. In comparison to coastal areas

¹ Focusing on entrepreneurs means that entrepreneurs have choices in behaviors. Their behaviors do not totally follow the governmental command or signals of market. In that point, Yukihiro Sato wrote, "Individual agent of action has a certain amount of autonomy. The decision making and action, formation and execution of strategy of individuals are not perfectly deterministic, though they are constrained by environmental conditions" (Sato, 2007, p.10). We agree with Sato at the level of epistemology. We, however, do not adopt his concrete method that the author concentrates on description of interrelations of individual action, because we emphasize both historical/structural factors and autonomous behaviors. At the level of precise case studies, Sato (2007) has little relevance to our study because he focused on semiconductor and personal computer industries.

² "Northeast region" generally covers the three northeast provinces: Heilongjiang, Jilin, and Liaoning. However, five leagues in the eastern part of the Inner Mongolia Autonomous Region are also included in the "Plan of Revitalizing Northeast China."

in the Southern and Eastern China regions, trends in economic stagnation in the region became more evident (Figure 2). Increased temporary layoffs (*Xiàgǎng*) due to unprofitable business operations at state-owned enterprises, accumulations of bad debts, and environmental issues also occurred (e.g., Seki 1993, Zhu 2008). Although this economic stagnation, called the “Northeast Phenomenon” temporarily improved thereafter, it became serious again around 2000, prompting the Chinese government to propose a plan of “Revitalizing Northeast China” during the 16th National Congress of the Communist Party of China (CPC), held in 2002.

The city of Dalian in Liaoning Province is well known as a heavy-chemical industrial city for machinery, rolling stock, ships, and petro chemistry. Located on the southern edge of the Liaodong Peninsula, Dalian has also been serving as an external gateway for the northeast region and growing as an international trade city. After the Chinese economic reform began, Dalian became open in 1984, earlier than other cities in the northeast region. The Economic and Technological Development Zones were also established to focus on attracting manufacturing industries. The comparison of GDP growth from the 1980s to 2000 between Dalian and other coastal cities shows that the GDP per capita for Dalian at that time was higher than those for Shenyang and Anshan, also located in Liaoning Province. However, the figure for Dalian was lower than those for Shanghai and Guangzhou, major cities in the coastal areas of the South and Eastern China regions (Figure 2). Facing this situation, the city of Dalian had already started to formulate measures to create a center for knowledge-intensive industries before the Chinese government implemented the plan to revitalize Northeast China.

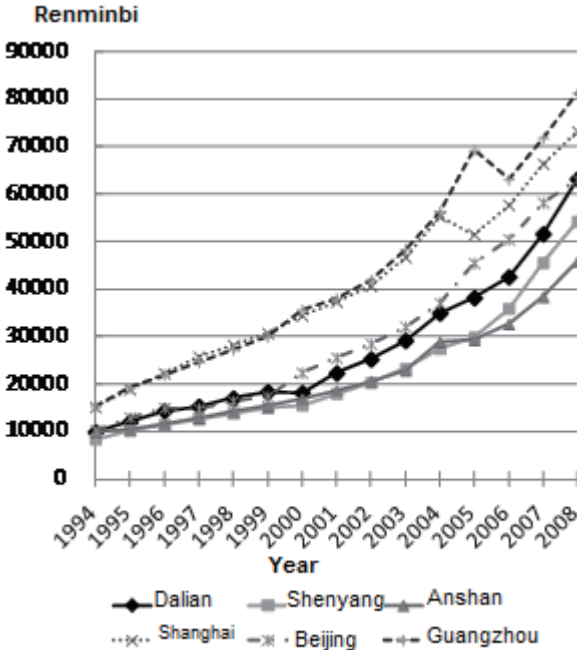


Figure 2: Comparison of economic growth in Dalian and major cities

Source: Created by the authors based on the annual “China City Statistical Yearbook”.

(2) Choice to Create a Knowledge-Intensive Industry Base

1) Establishment of the Dalian High-Tech Industrial Zone

In 1998, the Dalian municipal government officially proposed to promote the software industry. However, the furtherance of knowledge-intensive industries in a broader sense had already started in the late 1980s. First, the city of Dalian created its “High-Tech Street”, modeled after “Zhongguancun” in Beijing, but this generated no significant outcome (Gao 2008, p. 19). Subsequently, the Dalian High-Tech Industrial Zone (*Gāo xīn jì shù chǎn yè yuán qū*) was established at the same location in 1990, and was upgraded to become China’s first state-level high-tech park in 1991. Nonetheless, because “high-tech industries” included a mixture of various businesses (Li 2010, p. 6), and there was no clear direction for development, the park had an assortment of factories, offices, laboratories, and computer shops (Gao 2008).

2) Formulation of the Software Industry Promotion Policy

In 1997, while the northeast region continued to face economic predicaments, then-Mayor Bo Xilai began considering a transition of economic structure for the entire city and was encouraged to pursue software industry by various individuals, including the executive of the Charoen Pokphand Group in Thailand.³ Mayor Bo believed that software industry providing high value-added benefits with low pollution would support his strategy to develop a clean Dalian, so he paid 100,000 yuan to request that the Dalian Municipal Planning Committee and the Dalian University of Technology conduct a detailed industrial research. The results indicated that Dalian should pursue the development of software industry. In 1998, upon his return to Dalian from an official visit to Singapore, Mayor Bo proposed the “Construction of Dalian Software Park and Development of Information Industry” plan, which incorporated the research results, at the Dalian municipal government council meeting. He set up the Dalian Bureau of Information Industry and immediately began implementing the plan.

3) Important Roles Played by Former University Faculty Members

Some of the government leaders at the time, such as Deputy Mayor Xia Deren (who served as the mayor of Dalian from 2003 to 2009, and is the Deputy Secretary of the CPC Liaoning Province Committee as of 2011), Deputy Mayor Dai Yulin, Director-General of Dalian’s Science & Technology Bureau Qu Xiaofei (who serves as deputy mayor of Dalian as of 2011), and Director of the Bureau of Information Industry Luan Qingwei (who serves as Director of the Dalian High-Tech Industrial Zone as of 2011), were former university faculty members.⁴ Appointing individuals with these backgrounds to government posts was extremely rare in the local governments of China at that time. Based on numerous interviews conducted by Gao Lihua, it was clear that these leaders were highly aware of the

³ Descriptions in this paragraph are compiled from information based on Gao (2008), pp. 19-20, and Katoku (2005), p. 29 unless otherwise mentioned.

⁴ Descriptions in this paragraph are compiled from information based on Gao (2008), pp. 21-25.

knowledge-based industries around the world and the state of employment among university students. When assessing the transition of industrial structure, these leaders focused on acquiring many highly educated university graduates. They also had the perspectives to weigh comparative advantages, the international division of labor, and environmental conservation when considering city development, believing that Dalian's comparative advantage lay in its human resources and seeking to promote clean industries using those human resources. Thus, in addition to the mayor, who took strong initiative, many leaders in the municipal government began taking part in the furtherance of the software and information services industry. Moreover, those leaders, including Xia Deren that served as a mayor, made important roles to continue the industry promotion policies in 2000s.⁵

3. Process of Industry Formation

In Dalian, there are three major Chinese software corporations. One of them was attracted by the aforementioned policy implemented by the city, while the other two enterprises had already been established through the work of government agencies, universities, and foreign-affiliated companies before the municipal government started to implement the measure on a large scale. Thus, individual entrepreneurial activities preceded the municipal government action. This section attempts to examine the factors that led to the industrial formation by reviewing the foundation and invitation of the three major enterprises as well as the history of the software park's establishment.

(1) Foundation and Advancement of Major Corporations

1) Spin-Off and Foundation of DHC by the Dalian Information Center

This section starts by discussing about cases in which a company was established through spin-off of government agencies that went along with the transition to a market economy. In the case of the information services industry in Dalian, a spin-off of the Dalian Information Center (*Xīnxiāzhōngxīn*) was particularly important. First, members of the Information Center established the Dalian Xinhua Infotech Co., Ltd (DXC) as a business process outsourcing (BPO) company in 1992 when they obtained subcontracting works of data entry from NTT DATA, Japan. At first DXC had only seven staff members performing data entry for applications to open phone lines at the time of its foundation, the company had 1,100 employees by 2010, becoming one of the top-ranked Chinese BPO enterprises (DXC interviews, August 2010). In 1994, the Information Center participated in the "Green Card (*Lǜkǎ*)" project, part of China's postal savings system, and received technology transfers from NTT DATA. The postal savings system network in China became available nationwide through this project (NTT DATA [China] Co., Ltd. interviews, December 2010). Led by the members of this project, Dalian Hi-Think Computer Technology, Corp. (DHC), a software development enterprise, was founded in 1996. They continued growing by establishing a joint venture with NTT DATA and independently working on offshore developments for the Japanese market. They started with only five employees, including

⁵ About the continuity of the promotion policy for software and information services industry from 1990s to 2000s, see Xia (2010).

President Liu Jun, but the company had 3,400 employees as of 2009 and recorded 1.01 billion yuan of sales in 2010. Although it is ranked 50th in China based on sales volume (Ministry of Industry and Information Technology of the People's Republic of China, 2011), it has become the second-largest software enterprise in terms of exports because of its focus on offshore development business.⁶ The company is a private enterprise invested in by companies such as NTT DATA, NEC Soft, NS Solutions, and Microsoft, in addition to the founder group (DHC website).

2) Establishment of hiSoft by Industry-Academia Collaboration between Maritime University and the Japanese Corporation

HiSoft Technology International Limited (hiSoft) is a software enterprise that originated from the industry-academia collaboration between a local university and a Japanese corporation. Kawasaki Heavy Industries developed a relationship with Dalian Maritime College (currently Dalian Maritime University) when the company established a software development subsidiary in Dalian in 1991. Li Yuanming, who was serving as deputy director for the university's computer center, and others worked at the subsidiary for five years, learning not only the Japanese language and culture but also Japan's advanced technology, development expertise, and management methods. In 1996, With Li Yuanming playing a leading role in this effort, Dalian Haihui Sci-Tech Co., Ltd., the predecessor of hiSoft, was incorporated with funds from the Maritime University, Dalian Eastern Computer Group, and others (Mikayama 2003). Thus, the enterprise received technology transfers from a Japanese corporation in the form of industry-academia collaboration and initially grew by obtaining system development contracts for Japanese markets. The company then expanded into the U.S. market to scale up after it became a global development center authorized by GE. In 2010, it became the first Chinese IT service company to be listed on the NASDAQ. The management team currently consists of professionals who have worked at foreign companies; Li Yuanming, the founder of the corporation, has left the company to start another business. The sales of hiSoft reached 148.88 million dollars in 2010 (hiSoft 2010); the company is ranked third for the amount of software exports in China.

3) Neusoft's Expansion to Dalian from Shenyang

The expansion to Dalian by Neusoft Corporation (Neusoft), headquartered in Shenyang, also had significant implications. Neusoft's history of becoming a leading solution company has already been explained; it was first founded at Northeast University of Technology (currently Northeast University), and then grew through entrepreneurial actions based on founder Liu Jiren's experiences studying abroad in the United States, China's unique industry-academia collaborations, and business partnerships with foreign enterprises such as Alpine Electronics, Inc. (Kutsuzawa 2007). The company was ranked 10th in China in 2010, with 4.72 billion yuan in sales (Ministry of Industry and Information Technology 2011) and first in terms of exports. Part of the company group got listed on the stock market in 1996; the entire company group is now publicly traded. State and state-owned corporations, including

⁶ China Software Export and Service Outsourcing Ranking List. (2010). Export rankings hereafter are based on this source.

NEU Science & Technology Industry Co., Ltd., hold about 27.5% of ownership as major stockholders. The rest is held by Alpine Electronics, Toshiba, Intel, and its subsidiaries in China, and private investors (Neusoft Corporation 2010).

While Neusoft started the construction of China's first university software park (Neusoft Park) in Shenyang in 1995, the company was already searching for its next location around the time it successfully went public. They surveyed cities including Dalian, Xi'an, Nanjing, Changchun, and Dandong, and eventually determined that Dalian was the most appropriate location. In addition to being the outcome of ardent promotional activities by the city of Dalian, it seems that the company was attracted to Dalian's location as a center for offshore development as well as its advantageous relationship with Japan and accumulated human resources, described later. In Dalian at that time, Sun Yinhuan, the president of Yida Group, a private real estate enterprise that held the concession for the High-Tech Zone, worked independently to obtain an agreement from Chairman Liu Jiren on the development of Dalian Park, while cooperating with the High-Tech Zone Administrative Committee (Gao 2008, pp. 32-33).

Successfully attracting Neusoft had significant implications beyond adding one leading corporation to the city because it meant that the city secured an anchor tenant to establish Dalian Software Park (DLSP). In addition, Neusoft's decision to select Dalian as a base for business with Japan likely played a role in attracting the company's Japanese partners like Alpine and Toshiba. Furthermore, Neusoft founded the Dalian Neusoft Institute of Information in 2000. This university functioned as a base for supplying the IT workers that are always in demand throughout High-Tech Zone by sending its graduates to other companies as well as to Neusoft.

(2) Establishment of Dalian Software Park and Formation of Industrial Clusters

1) Establishing DLSP through the “Support from Government and Management by Private Enterprises” System

Yida Group, the aforementioned enterprise, was established as a real estate company in 1984.⁷ The company was commissioned to develop the Youjia Village Industrialization Base of Dalian High-Tech Industrial Zone by the Dalian municipal government in 1993. Its affiliated company, Dalian Bohai Machine Tool Co., Ltd. established a machine tools factory jointly with Japan's Nippei Toyama Corporation (currently Komatsu NTC, Ltd) in 1996, but the focus of the development had not been determined by that time. A researcher said that he had to walk on the muddy road and go through the bushes after getting out his car in order to visit the factory during the summer of 1998 (Seki 2006, p. 199).

However, President Sun learned from his experience with this machine tools factory the importance of pursuing business opportunities by collaborating with partners who possess high technical standards (Gao 2008, p.32). He also proceeded to solidify the plan to focus the effort on the software industry in response to the measures implemented by the city of Dalian. This eventually paved

⁷ All information related to Yida Group is based on the group's website unless otherwise mentioned.

the way to attracting Neusoft.

Thus, Yida Group built the Dalian Software Park (*Dàlián ruǎnjiàn yuán*) (DLSP) in June 1998 by positioning Neusoft as an anchor tenant. The distinguishing characteristic of DLSP is the “support from government and management by private enterprises” system: While supported by the city government, the park is a limited liability company 100% funded by Yida Group. This type of system was unlike any other state-level software park projects in China. With Neusoft Park and Neusoft Institute of Information at the center of the park, DLSP also offered offices for different types of information services companies by constructing buildings exclusively for large corporations and buildings with numerous rental spaces for small and medium-sized companies. In addition, the park provided various services, covering everything from stores and restaurants, to recruitment and training, to business partnerships, to communication with the governments.⁸ The aforementioned machine tools factory also went on to be surrounded by office buildings and the Neusoft Park (observed by the authors in August 2010). The number of tenant corporations at DLSP showed a steady increase, including both foreign and local companies, and reached a total of approximately 500 companies as of the end of 2010. Foreign companies make up 40% of the tenants, while Japanese companies account for 24% (DLSP website). DLSP covers about three square kilometers of land, but the construction of the second park, approximately four times as large, is underway, and some of the park is already in operation.

2) Formation of Industrial Clusters at DLSP and High-Tech Zone

As both Gao Lihua and Xia Deren (who was interviewed by Gao) pointed out, a win-win relationship seems to have emerged between DLSP and High-Tech Zone (Gao 2008, pp. 111-114). DLSP is geographically part of the vast High-Tech Zone and organizationally functions as one of the enterprises in that zone. Although High-Tech Zone and DLSP have different characteristics—the former being under “government management,” since it is administered by the municipal government, and the latter being under the “support by government and management by private enterprises” system—both are deeply involved with the Dalian municipal government. While High-Tech Zone supports DLSP, it also competes with DLSP, since attracting corporations to other parts of the Zone is essential. Using its agility as a private enterprise, DLSP offers tenant companies comprehensive services ranging from buildings to routine maintenance. In particular, DLSP grew tremendously as it earned a strong reputation for providing designated buildings for global corporations, such as GE, which required higher standards. This is a phenomenon called “companies attract other companies” (Li 2010, p. 12). Inspired by DLSP’s drive, High-Tech Zone also increased its focus on information services industry, obtaining the municipal government’s approval for new measures to establish “Hi-Tech Business Incubator” and “Animation Corridor,” and beginning to put effort into service improvements, promotional activities to attract enterprises, and assistance to startup businesses. As a result, DLSP and High-Tech Zone built a win-win relationship.

Moreover, the regional development by Yida Group generated positive externalities for all of High-Tech Zone, including DLSP, promoting the formation of industrial clusters. Yida Group provided

⁸ From Gao (2008) and interviews at DLSP (August, 2010).

life infrastructure elements such as condominiums and kindergartens in addition to building offices and laboratories. This type of improvement in the living environment further promoted the establishment of additional businesses, which also increased the opportunity for regional development projects.⁹

The sales volume for software and information services industry in Dalian reached 53.5 billion yuan in 2010. Of that, High-Tech Zone accounted for 50.6 billion yuan, or 94.6% of the sales in Dalian. Within High-Tech Zone, DLSP generated 28 billion yuan, while the other tenants generated 22.6 billion yuan (DLSP website). DLSP's predominance is clear; however, it should be noted that DLSP's win-win relationship with High-Tech Zone and successes in the development throughout High-Tech Zone have contributed to the industrial growth in the entire city of Dalian.

3) Increases in Orders and Investments from Japanese Corporations Seeking an Offshore Base

The period in which the city of Dalian started to focus on the information services industry corresponded to the time when the need for offshore development increased among Japanese companies. Due to a chronic shortage of labor in the 1990s (Japan Information Technology Services Industry Association 1992 pp. 115-117), Japanese companies in the information services industry pursued offshore development motivated mainly to reduce costs and secure human resources (Information Technology Promotion Agency, Japan IT Human Resources Development Division 2009, p. 290). Therefore, the cluster formation in Dalian, which provided a large number of programmers and engineers at low cost, was the ideal situation for Japanese corporations. Despite the trend of wage increases in China, the annual salary for a software engineer in China was only 16,289 U.S. dollars in 2009, while the Japanese counterpart earned 54,169 U.S. dollars (Information Technology Promotion Agency, Japan 2011, p. 45). Furthermore, wages also vary within China: The average annual wage paid by IT enterprises in Liaoning Province, where Dalian is located, was 39,741 yuan in 2006, which is significantly lower than the wages of 83,525 yuan and 81,851 yuan earned by IT counterparts in Shanghai and Beijing, respectively.¹⁰

The establishment of a public system development center for NEC by DHC in 1998 triggered large-scale offshore development by local enterprises. After 2000, this was followed by a series of direct investments from foreign corporations, including Japanese companies. By 2005, Japanese corporations such as Panasonic, Sony, and NEC Informatec Systems had built their bases in Dalian. Of all offshore development orders from Japan, which reached 20.3 billion yen in 2002, 9.8 billion yen were directed to China. By 2008, 56.5 billion yen out of 101.1 billion yen of total orders were for China (Information Technology Promotion Agency, Japan IT Human Resources Development Division, 2011, p. 109). There were cases in which offshore development was conducted by local companies receiving orders from Japanese corporations as well as cases in which Japanese companies conducted offshore

⁹ External effects with High-Tech Zone are discussed here; Gao (2008), p. 195, mentioned that external effects on hotel and air transportation industries in Dalian were also significant.

¹⁰ Kondo (2009), p. 30. The original source was created by NEC's Hirofumi Komiyama based on data from the National Bureau of Statistics of China.

development by establishing their subsidiaries in Dalian. In addition, European and American corporations in Dalian conducted businesses that targeted Japanese markets.

4. Abundance of Human Resources to Support Industrial Formation

(1) Human Resource Issues in Offshore Development Oriented Toward Japan

In general, the development of the software and information services industry essentially depends on human skills. In the case of offshore development oriented toward Japan, it further requires specific types of human resources and organizations because Japanese corporations prepare and verify specification documents in Japanese language when pursuing offshore development. It is also obvious that doing business in Japanese is necessary for BPO business because call center tasks and data entry are performed in Japanese language. Accordingly, the availability of ample talent able to use Japanese is a mandatory requirement to make an industrial cluster for offshore development and services for Japan. However, this alone is not adequate because workers must have business knowledge and be experts in information technology. It should be noted that Dalian completely met the former requirement and also met the latter requirement to some extent.

(2) Abundant Human Resources with Japanese Language Skills

The historic background explaining the increased human resources with Japanese language skills in Dalian can be traced back to the Japanese occupation of Manchuria before World War II. After the foundation of the People's Republic of China, however, the three northeast provinces continued to be regarded as a base for Japanese language education.

One pioneering figure was the establishment of the Dalian School of Japanese Language (currently the Dalian University of Foreign Languages) in 1964.¹¹ Despite stagnation in all foreign language education during the Cultural Revolution, Japanese language education in Dalian began flourishing again after the normalization of Sino-Japanese relations and the end of the Cultural Revolution.

The fact that Japanese education was provided at the elementary school level in Dalian deserves a special mention. This is a rarity in China, and Dalian was the only place in China where the Japanese language education materials for elementary schools were published. Subsequently, the status of the Japanese language has declined in elementary and middle school education as English education has increased throughout China; however, Japanese language education still continues in some areas.

¹¹ Descriptions in this paragraph and the following paragraph are based on information on the Japan Foundation website.

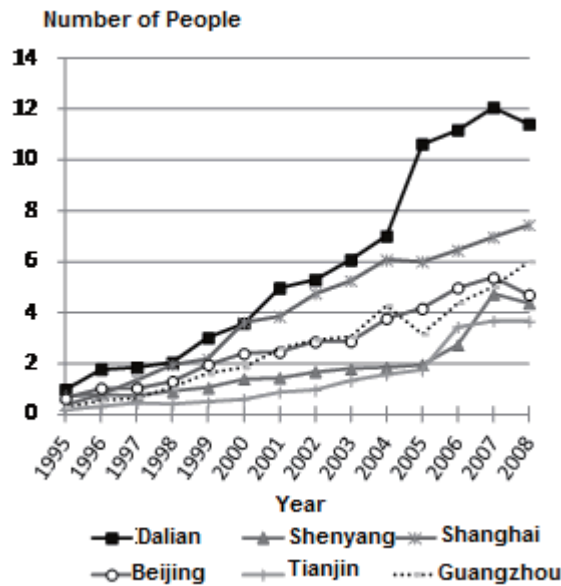


Figure 3: Change in the number of Level 1 Japanese Language Proficiency Test examinees per 10,000 populations in major cities in China

Source: Compiled by the authors based on the China City Statistical Yearbook and data from the Japan Foundation.

At the university level, 15 out of 29 universities located in Dalian provide a degree course in Japanese, with a total of 7,273 students enrolled as of 2007. Of all students majoring in Japanese in the three northeast provinces, 40.3% can be found in Dalian (document compiled by JETRO Dalian in June 2007). While the absolute number of Level 1 Japanese Language Proficiency Test examinees is higher in Shanghai and Beijing, the ratio of examinees to the population shows that Dalian has had the highest percentage among major cities in all but one year since 1995 (Figure 3). The abundant human resources with Japanese language skills became a foundation that allowed the offshore development and services oriented toward Japan.

(3) Brain Circulation and Technology Transfers

1) Brain Circulation and Technology Transfers between Dalian and Japan

Using three major corporations as examples, this section examines whether the brain circulation between Silicon Valley and India identified by Saxenian can also be observed in Dalian.

As mentioned previously, DHC received technology transfers from NTT DATA during the postal savings project conducted within China. Additionally, Liu Jun, one of the five founders, was trained at IBM Japan (Dalian Information Port website) while Wang Yue, also one of founders, had experience working at Japanese corporations (Gao 2008, p. 163).

Li Yuanming, a founder of hiSoft, worked as a manager at the subsidiary of Kawasaki Heavy Industries in Dalian from 1991 to 1996 to conduct joint research with the parent company. He also underwent training at Kawasaki's headquarters in Japan for one year during that period. He founded hiSoft in 1996 with six people whom he came to know at that time and started an offshore development

and system integration business targeting Japan (Gao 2008, pp. 164-166, Mikayama 2003).

As described earlier, Liu Jiren founded Neusoft based on his experience studying in the United States and research results obtained at Northeast University. The company received technology transfers related to marketing and embedded software from a Japanese corporation, Alpine (Kutsuzawa 2007).

Many instances are found among small and medium-sized companies, as well as major companies, of individuals with experience studying abroad or working for Japanese companies returning to Dalian and establishing companies to do businesses with Japanese companies using human networks they previously fostered. Although there is no specific statistical data, three enterprises the authors visited in August of 2010 and 2011 perfectly fit this pattern. In addition, there were companies founded by Chinese who returned to China after growing up in Japan as well as companies with executives, in addition to the founders, with experience studying abroad. Of all interviewees with offshore development business, there was only one company for which we could not confirm that the founder or upper management personnel had experience studying in Japan or working at Japanese companies.

Thus, the effect of brain circulation can be recognized in software enterprises in Dalian based on founders' backgrounds in studying abroad, work experience overseas, and the use of human networks built through these experiences. What is distinct is that, in many cases, they acquired skills and built human networks in Japan or through Japanese companies; Liu Jiren's experience in the United States is rather unusual. Moreover, the effect of technology transfers from Japanese corporations that Chinese engineers received in China is also observed.

2) Dalian as a Base for Studying Abroad in Japan

The underlying factors promoting brain circulation included the policy for studying abroad implemented by the Chinese government. Although privately funded study abroad gradually became liberalized in China starting in the 1980s, there were various restrictions until China became a member of the World Trade Organization in 2001 (Terakura 2011, pp. 187-190), and it is reasonable to assume that only a few students enjoyed the economic conditions to allow them to pursue privately funded overseas study in 1980s and 1990s. In other words, government policy had a significant impact on the selection and advance training of candidates for overseas study. Under such circumstances, Dalian was considered to be an important city that produced individuals ready to be sent to study in Japan. In 1978, when the central government implemented the measure aimed to establish "foreign language training centers (*chūguó lǚxuérényuán péixùn bù*)" at 11 universities and to send individuals to foreign universities and research institutes after providing short-term intensive foreign language education, Northeast Normal University and Dalian University of Foreign Languages were placed in charge of Japanese language education (Li 2008, p. 93), which targeted university graduates with technical expertise. In the last 30 years, a total of approximately 20,000 students have undergone intensive Japanese education training at the foreign language training center at the Dalian University of Foreign Languages (Li 2009, pp. 82, 89). Being designated as a base for overseas study in Japan can also be viewed as a factor that led to the brain circulation centered in Dalian.

3) Support for Business Start-ups and Measures to Develop and Secure Human Resources by the Municipal Government

The Dalian Municipal Government aggressively supported business start-ups by returnees and highly educated individuals. Dalian Hi-Tech Business Incubator was established in 1998 to provide opportunities for returnees from overseas study and individuals with Ph.D. degrees to start businesses. Software and information services companies also account for 45 to 50% of the park (Dalian Student Pioneer Park interviews, August 2011).

The city also focused on developing IT talent. Numerous universities were already located within or near the High-Tech Zone, but the establishment of Neusoft Institute of Information influenced other universities to set up schools and departments related to information services. By 2009, the number of undergraduate and graduate students enrolled in software-related majors reached 71,700, accounting for 27% of the entire undergraduate and graduate student body in Dalian (Dalian Economic and Information Technology Committee, et al. 2009, pp. 53-54).

5. Conclusion

Various external conditions created the context in which Dalian's software and information services industry could begin to develop, including the historic culmination of abundant human resources with Japanese language skills, the stagnation of traditional types of industries, and the demand from Japan for offshore development. Taking advantage of these conditions to create actual industrial formation involved quick, proactive behaviors by the municipal government leaders who aimed to create knowledge-intensive enterprises and the entrepreneurs who were growing in the process to market-oriented economy.

The proactive actions were taken from various perspectives. The municipal government presented their visions for industrial promotion and developed the software and high-tech parks and an environment appropriate for starting businesses while cooperating with private-sector enterprises. Although direct investment in China, especially from Japanese corporations, was essential, the characteristic of this industry was rather signified by the emergence of leading local companies and many small-to-medium sized companies. The brain circulation between Dalian and Japan played a significant role in founding local companies. At the same time, technology transfers to existing Chinese corporations were also effective. As a pathway to starting businesses, spin-offs from government agencies and universities were also important. In some cases, all of these elements, including brain circulation, technology transfers, and spin-off, can be found in a company. It means these aspects were interconnected with each other. The industry formation was actualized through the work of market competition and various prompt and timely behaviors of entrepreneurs, local governments, and foreign companies that operated in cooperation with one another.

The formation of the software and information services industry as a base for offshore development oriented toward Japan was an innovation from the perspective of a new industry vastly transforming the local industrial structure. While this value should be properly recognized, a different type of evaluation may be necessary from the perspective of global division of labor, because there is a

question as to which section of the global division of labor the industry in Dalian was able to enter. Another question is what type of transitions Dalian's software and information services industry have to face after the global financial crisis. These are issues that need to be addressed in the future.

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