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Description	一般講演要旨

An Exploration of Competitive Advantages in An Industry Cluster within Local Institutional Systems: The case of Dalian Software Park in China

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Abstract - In the development trajectory of Chinese software industry, software parks as industry clusters located in different cities, have played a leading role and received increasing attention with competitive advantages, which are originally from substantial supportive local institutional systems. This paper attempts to explore the competitive advantage of Chinese software parks for promoting industrial development. These industry clusters provide competitive advantage because they are rooted in local institutional systems. Taking the case of Dalian Software Park in China, this analysis is conducted qualitatively based on Porter's "diamond" model, SWOT framework and interview results. Industry clusters, which encompass a series of interconnected firms in designated geographic concentrations, show competitive advantages for industrial development with substantial resources rooted in local institutional systems including government, industry and academia aspects. In order to successfully navigate the economic paradigm shift from mass manufacturing production to innovative new product development in China, it is essential that the competitive advantages of industry clusters are strengthened and sustained in order to enhance industrial development, generate innovation and increase regional economic growth.

I. INTRODUCTION

1.1 Background

In recent years, ICT has been central to the discussions about economic growth and performance because it is pervasive and widely diffused. China, with its high economic growth, has also experienced tremendous change in its ICT development and has achieved considerable development in various sectors of ICT, particularly in the development of the software industry. The development history of the Chinese software industry is not so long. In its short history, a distinct industrial structure with two basic strategies including development in domestic market and export has been leading this effort. By stimulating the domestic market demand and encouraging software exports, software development resources are expected to be improved in terms of quality and in turn, induce the further expansion of the domestic market in this area and strengthen competitive advantages of the industry. Efforts have continued from the national level to promote software related industry clusters to realize the goals and achieve success in both domestic and international markets. Since the early 1990s, China has continually established many software parks including 11 national software industrial bases and 6 national software export bases, which formed the overall planning and layout of the Chinese software industry. Consequently, the development environment of the Chinese software industry has been dramatically improved and the awareness about the competitive advantages of these industry clusters has greatly increased. Thus, more research on the recognition and

improvement of competitive advantage in an industry cluster are indispensable.

1.2 Objective

This paper attempts to identify the institutional sources for the competitive advantage of Chinese software parks by taking the case of Dalian Software Park (DLSP). Dalian's local institutional systems, particularly their driving forces for software exports, are the focus. Section 2 introduces some related research work. Section 3 depicts the analytical framework including analytical methodology and data collection. Section 4 provides the results of the analyses, and then the implications are discussed.

II. LITERATURE REVIEW

Competitive advantage is now a popular term in many fields with the broader concept including national, industrial and firm levels. In the book "The Competitive Advantage of Nations" written by Porter, he stressed the important role "played by a nation's economic environment, institutions and policies" for successful competitive industry development. This paper analyzed the competitive advantage of industry clusters embedded in local institutional systems within the macro context of national institutional systems based on the "diamond" model presented by Porter.

Recent researches by Doeringer and Terkla examine the literature regarding industry clusters and identifies them as "geographical concentrations of industries that gain performance advantages through co-location". As a specialization and concentration of firms and industries in a region, they usually have common markets, share common suppliers, trade or education institutes, and intangible things like know-how and information exchange.

Since the establishment of software parks in the 1990s, the Chinese government launched 11 *National Level Software Industry Bases* in different cities including Beijing, Shanghai, Dalian, Jinan, Xian, Nanjing, Changsha, Chengdu, Hangzhou, Guangzhou and Zhuhai in 2001 and 6 software parks, located in Beijing, Shanghai, Dalian, Shenzhen, Tianjin and Xian, were authorized as *Software Export Bases* in 2003. Cities with software parks have emerged as leading software cities in China. When comparing the main software parks that have two identities as both a national level software industry base and a software export base in China, the software park in Dalian demonstrates particular excellence in exports, which can be attributed to a geographical advantage in Dalian as well as a more appropriate development strategy and industry policies supported by the local government.

At the same time, in DLSP, indigenous strength from Chinese firms and the learning effects of the global best practice from foreign firms are well fused. **Table 1** gives the number and ratio of local and foreign firms in DLSP. Compared with the 33% foreign firms in Shanghai's software park and 30% in Beijing's software park, DLSP demonstrates the highest rate of the foreign firms, which play significant roles in inducing the clustering and learning effects. Thus, under the clustering effects, firms from various countries with different culture backgrounds and institutional systems stimulate and encourage a co-evolutionary development leading to the win-win development.

DLSP's achievement can largely be attributed to the clustering effects inducing its good business environment, preferential supportive policies and huge talent pool of human resources. All of these factors are significantly rooted in its local institutional systems.

Table 1 Number of Chinese and foreign firms in DLSP (2005-2007)

Number of firms/Year	2005	2006	2007
Chinese firms	159 (60%)	211 (58%)	227 (58%)
Foreign firms	108 (40%)	153 (42%)	165 (42%)
(Global 500 corporations)	(22)	(27)	(33)
Total	267	364	392

Source: Author's summary based on introduction of Dalian Software Park.

III. ANALYTICAL FRAMEWORK

3.1 Methodology

This paper analyses the institutional sources for the competitive advantage of DLSP as an industry cluster. By means of the "diamond" model and SWOT (strength, weakness, opportunity and threat) analyses, the local institutional systems are analysed. The overall analytical methodology in this paper is based on a case study of DLSP. In addition to the general analyses described above, interview results are also added to provide more practical management implications based on managers' industrial experiences at DLSP.

The "diamond" model has been used as a framework for evaluating the competitiveness of regional industries and elucidating local industry clusters. It includes four important drivers as demand condition, factor condition, related and supporting industries, firm strategy, structure and rivalry. SWOT refers to strengths (S), weaknesses (W), opportunities (O) and threats (T). A SWOT analysis is useful in analysing firms' strategic management and identifying the level of firms in each respective dimension. In general, the SWOT analyses provides a much clearer map of the strengths, weaknesses, opportunities and threats of DLSP, making it aware of its strategic position and indicating how to strengthen its competitiveness. In order to support the general analyses from the industry's viewpoints, interview survey methodology was utilized that helped to evaluate more qualitative aspects and gain insights into the current issues in the development. The interviews of the selected firms were conducted in Dalian in January of 2007.

3.2 Data Collection

The majority of the statistical data used for this paper are from websites such as that for the China Software Industry Association, and published documents such as the Annual Report of Dalian Software and Information Service Industry and China Statistics Yearbook on High Technology Industry. In the interview survey, the selected firms are representatives of all firm types in DLSP including 4 branches of foreign firms, 2 China's top-ranked firms in software exports and one SME (Small Medium Enterprise). All the interviewees have

manager-level positions responsible for both project management and practical business management.

IV. RESULTS

4.1 Diamond model analysis

In order to highlight the competitive advantages of DLSP, the analysis was conducted focusing on the three dimensional aspects of government, industry and academia in combination with determinants of the "diamond" model. Since all the determinants of the "diamond" model can be reasonably summarized into these three-dimensional aspects, this kind of consideration for the analysis is appropriate. With detailed descriptions of supportive policies and strategic actions in the three dimensional aspects, it is noteworthy that the competitive advantages of DLSP are rooted in the cooperation between government, industry and academia. This cooperation is driven by the local institutional systems, which incorporate different important factor determinants of the "diamond" model respectively. The local institutional systems seem to be a "fertile soil" that promotes the growth of DLSP as a mature industry cluster and determines its competitive advantages.

(1) Government

Unlike Silicon Valley, DLSP was initially established and organized by the local government and developed with government support. Though Porter's view was that government is only a facilitator, the government has been playing a decisive role in the establishment and development of DLSP with well-organized infrastructure construction, top-down development guidance and supportive policies. Factor conditions in the "diamond" model including physical, capital resources and infrastructure can chiefly be attributed to the support from the government. In order to improve Intellectual Property (IP) protection awareness, the first IP service center in China was set up in DLSP under the Dalian government's help. Similarly, corresponding to the laws about private data protection in Japan, DLSP also took early action to provide guarantee for Japanese customers. In a word, continued efforts from the government lead to the achievement of DLSP.

(2) Industry

The establishment of DLSP is for promoting software industry development. Industry is the core part of this endeavor and includes all parts of the "diamond" model. In demand, rapid development of ICT and informatization construction provide huge domestic ICT markets and the need for human resources has a pull-through effect on the development of related IT training industry, which results in more innovations in traditional IT education at the universities. At the end of 2007, there were nearly 50 percent foreign firms in DLSP including significant participation by well-known multi-national corporations with Asian operations. This can be ascribed to the unique business environment, rich development resources and high potential for growth of DLSP. The competition and cooperation among the firms is considered to be another "virtuous self-propagating cycle" bringing out more innovative ideas which in turn continues to stimulate industry dynamics.

(3) Academia

The software industry, as a knowledge-intensive industry, cannot develop well without enough qualified human resources. The basic role of academia is to guarantee the availability of human resources as an important factor condition of the "diamond" model. Since the establishment of DLSP, software related education has been strengthened. In addition to the quantity, the current educational system focuses significant attention on the quality of graduates. Many private training institutes and centres are pursuing a new demand-oriented training model with more focus on practice to supplement the traditional education. For example, Neusoft Institute of

Information, invested by Neusoft Group as an independent institute, has specialized IT education institutes in Dalian, Nanhai and Chengdou since its establishment in 2000. This kind of business model as education institute invested by firm in Chinese software industry was the first case, which not only showed the characteristic of software industry but also suggested a good way of industrial demand/development leading to related industries development and education innovation. Dalian Neusoft Institute of Information, authorized as one of the 35 national model software professional institutes in China, is located in DLSP to pursue synergy effects with industrial development. By conducting business in education to provide more high-tech talents, it contributes to Dalian's local institutional systems with guarantee of high-tech talent pool. Because of substantial resources combination from Northeastern University, Neusoft Group and other international famous IT firms, it has both academic advantages of researches from North eastern University and industrial advantages of practice from IT industry firms. By collaborating with firms, basic research in the universities has a more practical focus in software research and development. This not only enhances the demand and reputation for the academic institutions but also promote the firms' capacity in the development of innovative products.

4.2 SWOT analysis

Following the "diamond" analysis summary of the Dalian's local institutional sources, the SWOT analysis, supplements and extends the concept of competitiveness to the general opportunities and threats, providing further insight into DLSP. SWOT also provides a mechanism for identifying areas in which the existing institutional systems can be improved. Strengths are the ways DLSP can obtain opportunities and face the existing threats. In most cases, weaknesses are considered to be the opposite of the strengths, but are areas that existing strengths cannot easily overcome. Strengths need to be further improved; weaknesses should be overcome; opportunities need to be taken; and threats should be changed to enhance competitiveness.

Though Dalian has a favorable geographical location, the increasing living cost is threatening the cost of human resources. Dalian's attractiveness should be strengthened both in hard aspects and soft aspects like improved legal environment. In order to guarantee the talent pool, traditional IT educational institutions are challenged to focus more on quality rather than quantity only. When some firms are playing the leadership role in the software industry's development, the performance gap exists and sometimes widens in the park. The problem is that many firms tend to pursue a popular technology without previous experience in this area. Thus, the formation of technology concentration creates bottlenecks for developing competitive advantage. Developing unique requisite technology (rather than everyone pursuing a similar technological area) will diminish these bottlenecks and reduce the performance gap making firms more competitive.

4.3 Interview results

In addition to the general analyses of institutional systems with the "diamond" model and SWOT, it is crucial to make the firms' strategic thinking clear and know what their real needs are. Considering the local institutional systems as a co-evolutionary process between government, industry and academia, the interview survey was focused on these three dimensions and results are summarized with respect to several important issues which consistently arose across the interviews regarding the general environment of DLSP to specific issues in software development, quality management, outsourcing and clustering effects, and education.

(1) Government

General opinions from interviewees are that they regard DLSP as a good environment to do business, and supportive policies from the government are substantial. However, in terms of the physical infrastructure, they consider the network including information exchange and cooperation among the firms in DLSP to be the most attractive feature. In particular, when they need some special skills from other firms for certain projects it is easier to get help from other firms if good connections have been established. Interestingly, the interviewees from foreign firms felt that competition in DLSP was healthy and would produce more innovative ideas, while interviewees from local firms felt that such competition is dangerous and risky, particularly for SMEs who pursue popular technology in software development without their own specialized skill. The SMEs felt that this was risky because their only competitive advantage was reduced costs. One interviewee said that his firm experienced this stage and that he could understand the difficulties faced by smaller firms for survival. He said it is crucial for SMEs to master some requisite skills as soon as possible to move beyond the simple labour cost advantage.

(2) Industry

Quality is still the core for software development. A successful project means not only few bugs but also corresponding standardization controls. In the past, many Chinese software firms focused more on meeting a deadline rather than quality control in project management. They recently have recognized the importance of getting international certification in software development. To achieve Capacity Mature Model (CMM) certification has been the goal for firms. Interviewees agree that CMM helps them be more standardized in project management. One Interviewee stated that passing CMM is very troublesome, but the process let them learn a lot and see an improvement. Standardization actually made project management much easier.

What are the key factors for success in outsourcing? This is a question that none of the respondents could provide a complete or exact answer. The interviewees mentioned internal and external factors. Some interviewees observed internal factors such as government support, a large talent pool of engineers and labor costs as advantageous. Other firms felt that specialized skill and foreign language proficiency were more important. Still other firms pointed out that in addition to the requisite technology and human resources, good connection and communication with customers was essential. These observations and industrial experience are very valuable for further development and research specifically on outsourcing in China. Factors mentioned here are all incorporated in the competitive advantages of DLSP and related to the local institutional systems. It can be concluded that the competitive advantages of DLSP lie in the positive actions taken by respective firms and the cooperation between these firms.

The competitive advantages of DLSP rely on Dalian's good geographical position, supportive governmental and industrial policies which are rooted in the local institutional systems as discussed above. The long-term goal for DLSP is to grow to be the largest resource centre for software, BPO and ITES [7]. Though DLSP has gained some success, in terms of creating opportunity for development and entrepreneurship. In the meantime, additional clustering effects of DLSP in enhancing competitiveness are expected. All interviewees observed that DLSP is showing great potential. This observation was based on expanded globalisation, Chinese economic growth, huge market demand and DLSP's own competitive advantages. One interview commented that their customers prefer to outsource to China more than ever before. More Chinese engineers now can speak English well and their skills were being highly evaluated. Since more foreign firms do business in Dalian, there were

being more opportunities. Some interviewees agreed that because of its geography and enormous talent in Japanese proficiency, Dalian would remain the first choice for Japanese firms in terms of outsourcing. One interviewee observed that the continually improved business and legal environment would provide lawful guarantee for the further development. In terms of clustering effects, all interviewees mentioned the networks among the firms in DLSP. Similar to the first question about DLSP, their answers concentrated on the topic of cooperation and competition. Though the term “clustering effects” had multiple meanings to the interviewees, they considered partnership to be the most important, since collaboration and information sharing are essential for success and resource supplement and technological upgrading can be accomplished best through partnership with other firms. In addition to the frequent connections among the firms, a manager club is operated and organized by DLSP every month in order to provide a chance for more communications between the managers from firms. One interviewee confirmed that by joining the club, through frequent communications with other firms, a partnership was formed and he received timely help when he had difficulties in project development.

(3) Academia

The talent pool of IT is undoubtedly a large focus of the software industry’s development. Though Dalian’s government is endeavouring to strengthen the IT education to guarantee human resource availability, the answers from the interviewees did not indicate that this was enough. They suggested that the current IT education at universities lacked a practical skills emphasis, which resulted in a negative attitude about the employment of new graduate students in some firms.

Some managers commented that the IT education in the universities was outdated. Though the basic education is important, practical contents were indispensable for IT education. They suggested that their decisions about the employment of new graduate students were dependent on whether they had some practical experiences or not. Because of this, they conducted some collaborative education with one university in Dalian to put practice into the traditional IT education. Firms are trying to gain win-win both in human resources and in firm revenues by expanding the IT training opportunities for students in their business. This supports traditional education and promotes the innovation in education.

V. CONCLUSIONS

China is facing a paradigm shift from labour-intensive manufacturing processing to the production of more high-tech innovative products, because development depending on low value added products is unsustainable. When trying to move up the value chain in the global context, the crucial strategy is to develop competitive advantage in high-tech industries as a priority. The specific action taken is to encourage industry cluster’ formations in different cities for regional economic growth. By taking the case of DLSP using qualitative data collection and analyses, this chapter identified the institutional resources of competitive advantages for DLSP and provided insights into industrial development. With the increasing awareness of competitive advantages in an industry cluster for industrial development and regional economics, the research highlights the role of local institutions in this competitiveness. Considering the determinants of the “diamond” model, local institutional systems are summarized into government, industry and academia vectors. After that, a SWOT analysis pointed out areas for further improvement and development by identifying the strengths, weaknesses, opportunities and threats faced by DLSP. Interview data reflected the observations from the

industry supporting the general analyses. Noteworthy findings include:

(i) The establishment of these industry clusters provides the industry with a favorable business environment that includes attractive incentives and a well-constructed infrastructure such as communication facilities and environmental services to support the functionality development of Chinese software industry.

(ii) Behind the tangibly visible constructions, the potential intangible effects from the clustering of firms in industry clusters are an important issue. The clustering effect stimulates more competition and collaboration among firms to produce more innovative ideas and establish a win-win environment.

(iii) This process of competition and collaboration among the clustering firms, referred to as co-evolution, leads to good performance among the firms. Because of the clustering effects, the firms grow and promote related industry development, and then play a profound role in regional economics by growing to be more competitive internationally.

(iv) The success of DLSP as an industry cluster is based on the institutional sources including all the efforts from government, industry and academia as demonstrated in the “diamond” analysis. As the epitome of Chinese institutional systems with characteristics analysed in Chapter II, DLSP is a very good model of a localized cluster in which development is deeply rooted in its local institutional systems. It turns out to be a co-evolutionary development between DLSP and the local institutional systems.

(v) Similarly, DLSP displays its competitive advantages by encouraging networks among firms, integrating into the international value chain of activities and improving its reputation internationally. By utilizing an array of resources from different firms, the clustering effects of DLSP stimulate more innovation and facilitate industrial regional economic development. Undoubtedly, as analysed in SWOT, some weakness and underlying threats are still faced by DLSP. Interview results show that opportunities and challenges co-exist in DLSP. Observations from industry can be practical suggestions for further development of DLSP.

Since the clustering effect from networks is strongly observed and presented from the interview, lack of empirical analyses of networks in the industry cluster is the research limitation. Therefore, empirical analyses of networks should be a future undertaking to further elucidates the relationship and mechanism for cooperation and innovation among the clustered firms.

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