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Introduction

This paper aims at analyzing entrepreneurial universities and their industrial creation model in China. I attempt to identify the dynamic role played by the government, industry and academia at each stage of the market economy's development in China. I focus more particularly on the changing nature of the relationship between market and university through an historical and comparative approach.

Production of new knowledge has become a fundamental basis of economic development emphasized by globalization. How to link universities to industries is a central issue for emerging and advanced nations. Therefore, collaboration between university and industry is well recognized for being a determinant subject of research. China represents a particularly interesting case of analysis in the extent that industry and academic are sharing a research-oriented collaboration, which might be one of the main factors of its economic development and its model of innovation as well.

This paper aims at answering three questions to shed light on China's dynamism to link industry and academic and the specific mechanisms involved from the 1980's. First, we investigate the reasons of the success for the Chinese linkage's concept between university and industry from the 1980's to the 1990's. Then, we analyze the development of a new structure called "Science Park", and finally, we examine why since the 2000's University-run enterprises have switched from a direct management to a holding company's type of indirect management.

This paper focuses on the role played by university-industry collaboration in developing and industrializing science technology for rapid economic development. We first clarify the actual state and development of university-industry collaboration from 1980s to 2000s, and then aim to describe the mechanism of university-industry collaboration and a success factor in a specific case study.

1. Topics and period divisions

This research examines the actual state of university-industry collaboration

in China from a historical perspective and attempts to clarify the industrial creation role that universities fulfill and the changes to that role. To this end, this research compiles the history and actual state of university-industry collaboration from the 1980's to the present based on the analysis of macro data and covers representative cases of university-industry collaboration initiatives.

In recent years the rapid development of the Chinese economy has captured global attention. In particular, the role fulfilled by the university through university-industry collaboration in the development and industrialization of science and technology has attracted attention. In market economics, the role of industrial creation should essentially be made the responsibility of companies. However, in the catch-up economic development model of China, the university has been fulfilling the role of industrial creation through university-industry collaboration.

In order to understand the chronological development of university-industrial collaboration in its current state of change, this research focuses particularly on the initiatives of universities, with further analysis through addressing the following three questions:

1) Why was it possible for universities to fulfill the industrial creation role through university-industry collaboration in China?
2) How did that role change?
3) Why did those changes occur?

In order to understand the actual state and transition of university-industry collaboration in China, this paper first provides an overview of the history of China's university-industry collaboration and then divides this history into time periods. Many previous studies divided the periods of China's university-industry collaboration based on developments in system and policy. In contrast to previous studies, this research focuses on the actual state of university-industry collaboration and, as a result, separates the chronological development of university-industry collaboration into the following 2 periods: Namely, the era of a direct type of industrial creation from the 1980's to the 1990's represented by university-run enterprises, and the era of the indirect type of industrial creation from the beginning of the 21st century onward that emphasizes new technology transfer, as well as incubation facilities like university-founded science parks.

We first consider this transformation of the state of university-industry collaboration from a macro perspective. Specifically, three aspects of the chronological development of university-industry collaboration in China are considered, namely the transformation from university-run enterprises to university-owned enterprises, the status of university technology transfer in China, and the expansion of university-founded science parks.

2. The era of the direct type of industrial creation

The period of university-industrial collaboration from the 1980's to the 1990's was an era characterized by a direct type of industrial creation represented by university-run enterprises. The transformation from a "planned economy" to a "market economy" in China began with the liberalization and reforms of 1978, which have become a turning point for the entry into a new era. Under the former planned economy system, companies simply followed the production plans of high ranking bureaucrats in order to fulfill production goals with no management autonomy for the procurement of economic profits. Hence, there was none of the pressure inherent in market competition, and likewise there was no requirement to respond to market needs. Universities, with their wealth of talent and the support they received from the government's scientific research fund, had been singlehandedly fulfilling their roles as the institutions responsible for the nation's scientific research and technology development. The transition to a full-market economy in 1992 marked strengthened support for university-run enterprises in terms of taxation. At the year-end nationwide university science and technology industry conference in 1993, "National Prosperity through Science and Technology" by way of university-industry cooperation was formally announced and instituted as the 3rd function of universities next to education and research. University-industry collaboration was also added as a criterion for university evaluation, and where it was originally instituted with the negative purpose of resolving shortfalls in funding, university-industry cooperation was now used to accomplish a positive purpose. In this manner, university-industry collaboration in 1990's China faced a period of expansion and rapid development.

This initial period of university-industry collaboration was not characterized by simple collaboration between existing companies and universities, but by the mainstream establishment of university-run enterprises that relied on technology developed by the university. University-run enterprises not only transfer technology within the university, but are also connected directly with enterprise management and collaborate in various funding, technology, and human resource related areas. In other words, university-run enterprises were the university's direct means of market participation.

Three factors contribute to the reason that university-run enterprises became the mainstream form of university-industry collaboration during this period. First, the university had accumulated research capability and positioned itself as a research institution. During the mid-1980s in China, science and technology prowess was held not by enterprises, but largely by universities and research institutions. Universities were not simply educational institutions, but were put in the crucial position of functioning as research institutions. Second is the external market environment. At this time in China, there was no means to transfer technology held by universities to existing enterprises, because there was no receiving channel in the market, thus

making adjustment costs too big. Because of this, it was more advantageous for technology experts within the university to create the enterprise. Representative of the university-run enterprises created during this period are companies such as Peking University Founder, Tsinghua Tongfang, and Neusoft. The third reason is the preferential policies outlined by the government and its structural flexibility. The government not only outlined a preferential tax policy for the establishment of high tech enterprises, but also sanctioned concurrent posting for science and technology experts as national policy, which made it possible for researchers to start ventures without losing their university jobs. Through these measures, the entrepreneurial desires of university researchers were roused, and a milieu that was supportive of business start-ups was also formed. From the beginning of the 1990's, university-run, high tech enterprises expanded rapidly and entered the mainstream market. High Tech Universities took on the risk of directly entering the market and supplemented a portion of the industrial creation.

Table 1: Change in financial status of university-run enterprises from 1997 to 2009.

Year	# of Enterprises	Total Sales	Average Revenue per Enterprise	Total Profit	Tax Paid
	(# of Enterprises)	(00,000,000s yuan)	(000,000s yuan)	(00,000,000s yuan)	(00,000,000s yuan)
1997	6634	295.5	4.5	27.2	12.3
1998	5928	315.6	5.3	25.9	13.5
1999	5444	379.0	7.0	30.5	15.7
2000	5451	484.6	8.9	45.6	25.4
2001	5039	603.0	12.0	48.2	28.4
2002	5047	720.1	14.3	45.9	36.3
2003	4839	826.7	17.1	43.0	38.7
2004	4563	969.3	21.2	49.9	48.7
2005	4311	1071.3	24.9	55.6	48.1
2006	3988	1167.3	29.3	59.5	44.7
2007	3665	1373.6	37.5	118.5	57.0
2008	3691	1232.4	33.4	71.2	94.7
2009	3643	1412.3	38.8	87.4	117.6

(Source) Author's compilation of yearly data from "Zhongguo Gaodeng Xuexiao Xiaoban Chanye Tongji Ziliao" Note: Data before 1996 is not available.

However, the trend for university-run enterprises, which had experienced a period of rapid growth in the first half of the 1990's, began a trend of decline with 1997

as the demarcation. Table 1 shows the change in the financial status of university-run enterprises from 1997 to 2009. The 6634 university-run enterprises operating in 1997 had decreased by nearly half to 3643 in 2009. On one hand, when considering the overall financial status of university-run enterprises, the overall trend is upward, with 2009 total revenues at 141.23 billion yuan and the amount of tax paid at 11.76 billion yuan. Furthermore, the average sales volume per enterprise increased from 4.5 million yuan in 1993 to 3880 yuan in 2009. University-run enterprises saw an increase in not only taxes paid, but also in the amounts returned to the universities. The amount returned to universities reached 4.17 billion yuan in 2009 which accounted for 73.5% of the 5.68 billion yuan of net profit from university-run enterprises across the nation. This indicates that a survival of the fittest situation was generated among university-run enterprises wherein the successful university-run enterprises continued to grow while the selection of university-run enterprises also increased.

3. The era of indirect industrial creation

Structural transition from university-run enterprises to university-owned enterprises

With the rapid expansion of the university-industry collaboration in the 1990's, the importance of this collaboration in China's economic development had been established. However, at the dawn of the 21st century, university-run enterprises were facing a major transition. "University-run" enterprises underwent a structural reformation to become "university-owned" enterprises.

Along with the development of university-run enterprises, various problems emerged between universities and enterprises in relation to property rights and the management authority of enterprises. At the time university-run enterprises were established, the universities assumed the risks and held unlimited responsibility for the management. However, with the increase of university-run enterprises, the large amount of business risk undertaken by university-run enterprises that had been directly managed by universities became a heated topic regarding the future state of relationships between university-run enterprises and the universities. Soon after, due to administrative guidance from the government, university-run enterprises, beginning with Peking University and Tsinghua University, underwent a structural reformation that began in 2002. In 2006, a reformation began of university-run enterprises throughout China based on the sequence of events of university-run enterprise reformation at Peking University and Tsinghua University.

The management structural reformation of university-run enterprises was primarily conducted in the following 3 facets. 1) Establish a holding company, commission that same company to manage the assets of the university, and manage the enterprise under its auspices. Furthermore, the university does not directly manage outside investments, but must go through the holding company for everything.

2) Regarding the use of the university names, existing university-run enterprises adjusted their naming, and in principle, use of the university name was prohibited. 3) From a human resource perspective, concurrent posting at the enterprise with a teaching position at the university was prohibited in principle. The establishment of a university holding company required permission from a government agency, specifically the Ministry of Education, and the holding company assumed the position as the enterprise managing the national assets held by the university. Following this guidance, holding companies were established in the form of limited liability companies within universities.

Table 2: A comparison of university-run enterprises before and after structural reform

	Before structural reform (University-run enterprises)	After structural reform (University-owned enterprises)
Liability of the University	Unlimited liability	Limited liability
Operations division	Government division within the university	Holding company
Relationship between university and enterprise	Directly managed by the university Personal connection Administrative connection	Solely an indirect financial connection through the holding company
Business risk	Unlimited liability for the university	Limited liability for the university

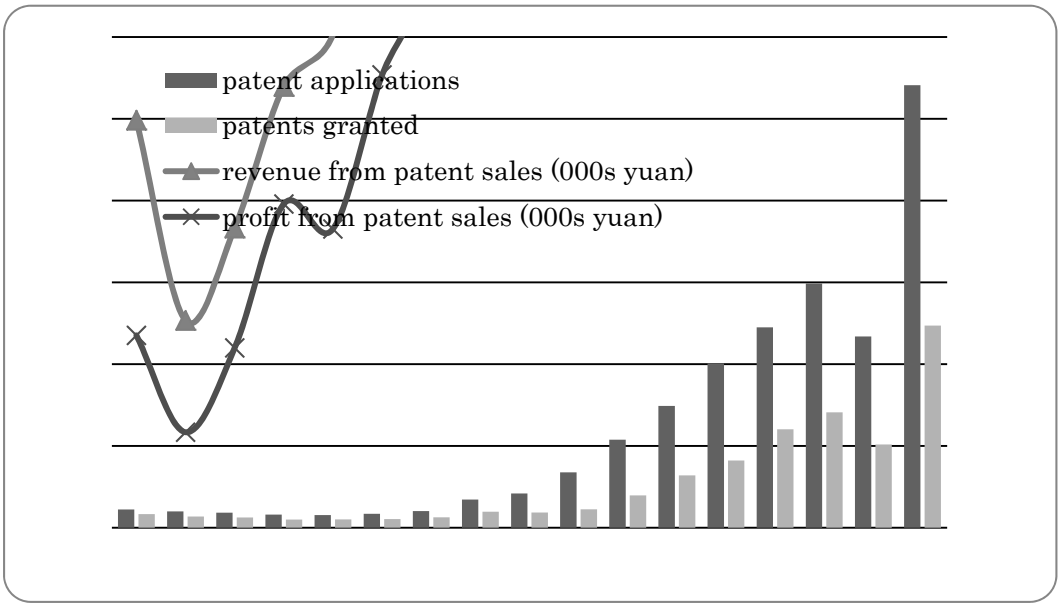
(Source) Author's compilation from "A Study of Knowledge-Based Innovation and Technology Spin-offs in Chinese University" (2009)

In essence, holding companies fulfilled the role of a firewall allowing the universities to avoid the business risks associated with the university-run enterprises. Furthermore, this presented the opportunity for structural reform of university-run enterprises at each university, and thus began the introduction of the enterprise structure of today. By 2009, 157 of the 484 universities nationwide had already established holding companies. Total sales of the 157 holding companies reached 115.13 billion yuan, accounting for 81.5% of the 141.23 billion yuan in total sales of university-run enterprises.

The evolution of technology transfer in universities

The study of not only university-run enterprises, but also the trends in patents and technology transfers, sheds light on one more aspect of industry-university collaboration. First, the patent trends occurring in nationwide universities from 1993 to 2009 are displayed (Figure 1)

Figure 1 patent trends occurring in universities from 1993-2009

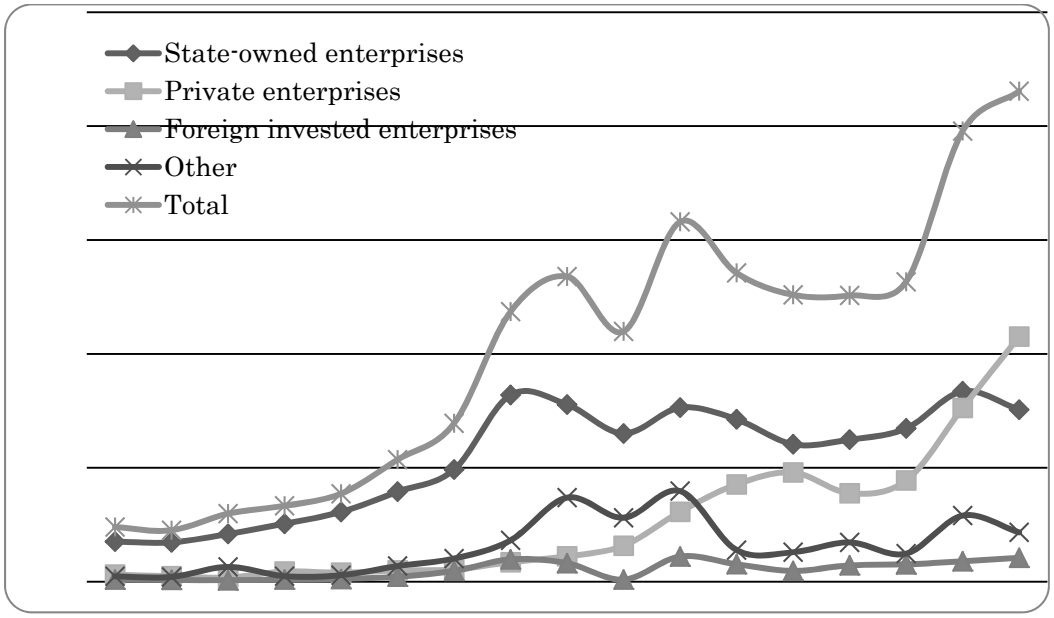


(Source) Author's compilation of yearly data from "Gaodeng Xuexiao Keji Tongji Ziliao Huibian"

The number of university patents applied for and granted remained steadily below 2000 until 1999. In 2009, however, the number of patent applications reached 54099 and the number of patents granted reached 24708. A particularly rapid increase is shown after the year 2000. Sales volume and profits from the sale of patents both exceeded 100 million yuan beginning in 2000, with sales volume reaching 760 million yuan and profit reaching 560 million yuan in 2009.

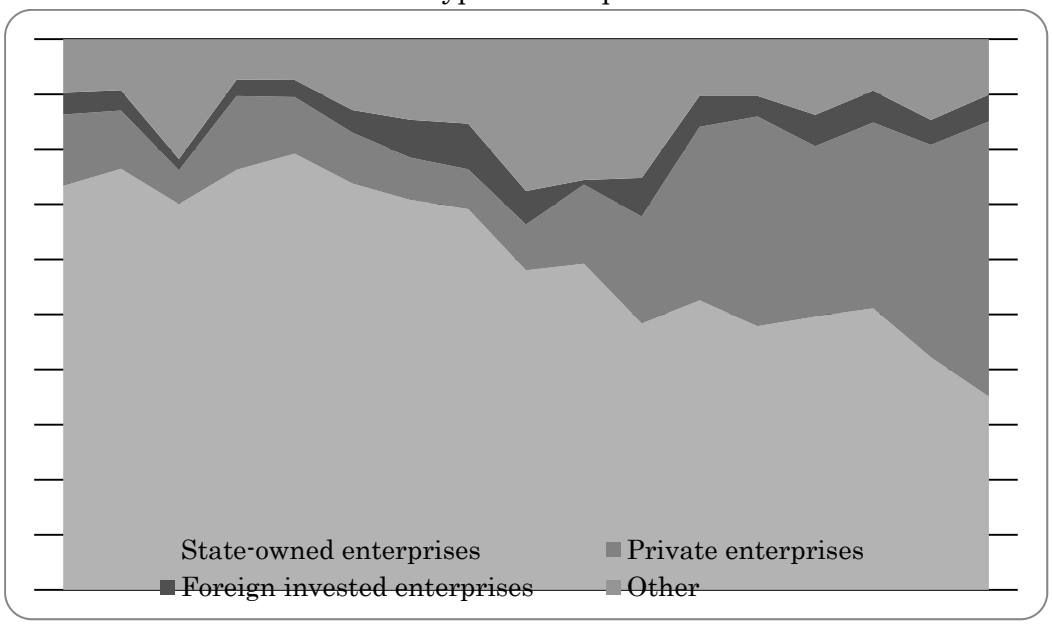
Next, the technology transfer trends at nationwide universities are examined. Figure 2 and Figure 3 shows the trends by percentage of income derived by universities nationwide from technology contracts categorized by enterprise type. As Figure 2 and Figure 3 shows, the percentage of income from state-owned enterprises, which had been the chief recipients of technology transfers from universities, fell from 73.3% in 1993 to 35.1% in 2009. Conversely, technology transfers to private enterprises increased, with a particularly rapid increase in 2004, until 2009 when about 50% of income from patent transfers was derived from private enterprises. On the other hand, the scale of technology transfer to foreign-invested enterprises was small in comparison to private enterprise, and the percentages did not exhibit much change over time. It is clear that the universities, which had been positioned as a segment of the national research/development institution, transitioned from a situation where they mostly transferred technology to state-owned enterprises, to the status of gradually strengthening their collaboration with various private enterprises that are active in the marketplace.

Figure 2　The income from technology contracts between universities and each type of enterprise from 1993 to 2009 (unit of measure: 1000 yuan)



(Source) Author's compilation of yearly data from "Gaodeng Xuexiao Keji Tongji Ziliao Huibian"

Figure 3　The percentage of income from technology contracts between universities and each type of enterprise from 1993 to 2009



(Source) Author's compilation of yearly data from "Gaodeng Xuexiao Keji Tongji Ziliao Huibian"

The spread of university-founded science parks

With the decline in the direct form of industrial creation at universities through university-run enterprises in the latter half of the 1990's, the dawn of the 21st century saw a surge in university-founded science parks which became the

outstanding characteristic of this period of China's university-industry collaboration. While university-founded science parks began playing a major role in the university-industry collaboration after the dawn of the 21st century, the establishment of the structure itself began around 1990. In 1998, the establishment of Northeastern University Science Park was the first, and it was followed by the development of science parks at Peking University and Tsinghua University that quickly commenced building their own science parks. In spite of this, the development of university-founded science parks was still in the initial stages nationwide until the 1990's. The purpose of building university-founded science parks at the time was mainly facilitating the industrialization of technology in the universities through start-ups.

However, even though university-founded science parks were established, the industrialization of technology through them did not proceed as originally expected. The university-founded science parks were involved not only in the aspect of technology transfer of research results achieved in the university to industry, but also in aspects of real estate and the comprehensive development of districts including the surrounding infrastructure. Furthermore, the enterprises established within university-founded science parks were able to achieve large-scale development due to the various preferential policies from the state. Within the university-founded science parks in China, there are those that were established in cooperation with government in high tech industrial districts and those that were established through the support of regional government in collaboration with multiple universities or by individual universities together with regional government.

As institutions promoting university-industry collaboration, university-founded science parks fulfilled the incubation function from the dual aspects of providing the physical space (hard aspect) and also the various supporting structures (soft aspect). The hard aspect of physical space provided by university-founded science parks was the creation of an environment that eased the entrance particularly for technology-endowed university faculty and students (including graduates). The high tech enterprises that were moving into the university-founded science parks were able to absorb the outcomes of the universities' science and technology, undertake joint research with universities, and use the science park in order to industrialize laboratory technology. The soft aspects of the university-founded science parks were the various forms in which industrialization was supported. Examples include guidance in patent applications, and support of the necessary procedures required when establishing a corporation. The support that residents received from moving into a university-founded science park was not only university technology and the support of intellectual resources such as human resources, etc., but also the positive support of from the maturation of technology to its industrialization, through support systems within the park.

After the year 2000, the government began national level certifications in order to realize the "Prosperous nation of science and technology" strategy. There were 22 university-founded science parks that had achieved the first nationwide approval in 2001, and by the end of 2009, this number had increased to 69 nationwide. These were dispersed across the entire nation in 24 provinces and 31 cities (25 in the eastern region, 10 in the central region, and 14 in the western region - Table 3).

Table 3: Number of university-founded science parks that were recognized on a national level in 2009 – shown by area.

Beijing	13	Shanxi	1	Yunnan	1
Shanghai	10	Anhui	1	Sichuan	4
Jiangsu	7	Hunan	1	Chongqing	2
Guangdong	3	Jilin	1	Xinjiang	1
Shandong	3	Jiangxi	1	Gansu	2
Zhejiang	3	Henan	1	Shanxi	4
Hebei	1	Hubei	1	Fujian	1
Liaoning	2	Heilongjiang	3	Tianjin	2

(Source) Ministry of Education, Science and Technology Development Center

Table 4: Development trends of university-founded science parks (2002-2010)

Category	Technology incubators (# of locations)	Area (0,000s ㎡)	# of enterprises moved to science parks	# of people within the enterprises moved to science parks (10000)	# of enterprises moved to science parks for the given year	Cumulative number of native enterprises
2002 年	58	145	2380	5.2	867	720
2003 年	58	578.4	4100	7.1	1099	984
2004 年	46	485.3	5037	7.0	1156	1256
2005 年	49	500.5	6075	11.0	1213	1320
2006 年	62	516.5	6720	13.6	1384	1794
2007 年	62	528.3	6574	12.9	1359	1958
2008 年	68	698.2	6173	12.5	1294	2979
2009 年	76	814.3	6541	13.9	1396	3673
2010 年	86	814.5	6617	12.8	1858	4364

(Source) Ministry of Education, Science and Technology Development Center

These university-founded science parks received preferential projects and

grants and were positioned as important incubation systems, not just within the university, but from a national perspective as well.

The rapid development of university-founded science parks after the beginning of the 21st century is represented in Table 4. There were 22 university-founded science parks that achieved the first nationwide approval in 2001, and by the end of 2010, this number had increased to 86. These university-founded science parks received preferential projects and grants, and were positioned as important incubation systems, not just within the university, but from a national perspective as well. The development trend of university-founded science parks from 2002 until 2010 shows a large increase in the scale of university-founded science parks from 2003, as well as a large increase in the number of enterprises moving in.

4. Case studies of university-industry collaboration

Taking notice of Neusoft

The experience of Neusoft Group is a case of a local university-run enterprise in China that grew to be a global enterprise. The 20-year history of Neusoft, which was founded in 1991, reflects the transformation from the direct industrial creation era to the indirect industrial creation era of university-industry collaboration. In addition, the case illustrates the growth process from a local university-run enterprise to a global enterprise.

Neusoft is a university-run enterprise founded by Northeastern University in Shen- yang, China. Neusoft, which celebrated 20 years since their founding in 2011, has gro- wn to become the largest enterprise providing IT solutions in China. Total 2011 reven- ue for Neusoft reached 5.75 billion yuan with total profits for the same year at 490 mil- lion yuan. Breaking down the revenue by business category reveals that the software field occupies approximately 84% with 4.83 billion yuan in revenue. With over 20,000 employees, Neusoft has large-scale software research and development centers at six locations in China and is expanding area headquarters to eight locations. Furthermore, Neusoft is constructing marketing and service networks in over 40 domestic cities and has three Neusoft Institutes of Information and one Biomedical Information and Engi- neering Institute in DaLian, NanHai, ChengDu, and Shenyang.

Neusoft also boasts the leading position in exports of software enterprises in China with a positive outlook for global expansion. Neusoft experienced particularly rapid global expansion after the dawn of the 21st century. Revenues from abroad represented approximately 10% of the total in 2000, growing to approximately 32% by 2011.In 2000, “Neusoft Hong Kong” and “Neusoft America” were established, followed by “Neusoft Japan” in 2001 and “Neusoft Europe” in 2009. In 2006, SAP and Intel vacillated and finally decided to invest in Neusoft, becoming Neusoft’s strategic

investment partners. In 2009, Neusoft agreed to an equity purchase with Sesca in Finland and purchased Sesca's high-end smartphone development business. Currently, Neusoft has local corporations in Japan, the USA, Europe, the Middle East, Hong Kong, and India.

Neusoft and Northeastern University

Neusoft traces its roots to the "computer networking engineering laboratory" started by three young educators at Northeastern University in Shenyang, China in 1988 with a scientific research grant of 30,000 yuan and three 286 computers. As China's first doctor of computer applications, Dr. Jiren Liu was appointed to the position of head of the laboratory soon after his arrival to work at his alma mater Northeastern University from study abroad in the United States. Dr. Liu is currently the CEO of Neusoft. While studying in the United States, Dr. Liu began to develop a strong affinity for university-industry collaboration and the industrialization of technology between universities and research institutes. Northeastern University was originally known for metallurgy, but due to lack of funding at the time, it was not feasible to foster Indus- tries that required large-scale investment. Dr. Liu focused on the field of software. Even though Dr. Liu harbored expectations for the software field to positively contribute to the university's future, the necessary funding for the research and development was still a significant problem. What played a major role in solving this problem was the relationship between Northeastern University and Alpine Electronics,Inc..

Toward the end of the 1980's, Japan's car audio manufacturer, Alpine Electronics, Inc. was looking for a production location in Asia, and particularly in China, in order to lower production costs. While researching the northeastern region of China, Alpine visited Northeastern University, learned of the existence of the computer networking engineering laboratory, and became very interested in the research of Dr. Liu and his colleagues. This became the opportunity for Northeastern University to begin a business alliance with Alpine Electronics, Inc., in 1989, using the same laboratory for the location, and participate in technology export and software outsourcing. Dr. Liu was able to continue his research into the software field using 300,000 dollars obtained from the business alliance between Northeastern University and Alpine Electronics, Inc as research funds. From Northeastern University's perspective, Alpine Electronics, Inc. was their first overseas alliance partner and was crucial in resolving the funding difficulty that occurs in the initial phases of research and development, including the university-run enterprises to follow.

As they began to see the success of their research and development, Dr. Liu and his two teaching colleagues at the computer networking engineering laboratory proposed the slogan "Bridging Software Research and Application" and set foot on the path of entrepreneurship with the establishment of OPENSOFT System Development

Company in 1991. Contributing to this sequence of events was Dr. Liu and his colleagues' strong desire to personally effect the industrialization of their research results. In the same year, Northeastern University started up Neu-Alpine Software Research Institute (a limited liability company) in conjunction with Alpine Electronics, Inc. Initial capitalization of the venture was 250,000 dollars with 10% of the investment from Alpine Electronics, Inc. In 1993,OPENSOFT System Development Company, the company established by Dr. Liu and colleagues, merged with Neu-Alpine Software Research Institute (a limited liability company) to form Shenyang Neu-Alpine Software Co., Ltd.. This same company was listed on the Shanghai securities market in 1996. This was a first for a China founded software company and also a first for a China-Japan joint venture. In 2001, Neu-Alpine changed its name to Neusoft Co. Ltd.

The transformation and expansion of university-industry collaboration

Neusoft had confirmed the future of the software industry through their collabora- tion with Alpine Electronics, Inc. Furthermore, they recognized the need for speciali- zed human resources and networks through business expansion, and laid the ground- work themselves for the structuring and nurturing of the same.

Specifically, through the involvement of Neusoft, ground was broken on China's first university software park (Shenyang NEU Software Park) in Shenyang in 1995.In 1998, the building of a park in DaLian also commenced. With the building of the software park in DaLian, Neusoft set their sights on expanding the network beyond their home city of Shenyang.

Furthermore, they garnered their own investment and developed their own IT human resources. In the year 2000, Neusoft Institute of Information was established in DaLian Software Park as a department of Northeastern University with 60% of the investment coming from the Neusoft Group and 40% from DaLian Software Park. In 2002, NanHai Neusoft Institute of Information and Chengdu Neusoft Institute of Information were opened in succession and began operation. Currently, the group has three universities specializing in IT with enrollment surpassing 25,000.

In the case of Neusoft, forming a network and developing human resources on their own is an aspect that differs from the direct industrial creation university-industry collaboration model. It is worth noting that the network formed from the software park expands beyond the relationship between Northeastern University and Neusoft. For example, the development of the human resources who become the future industry lea- ders takes place at the aforementioned IT institutes, which supply many enterprises with talent that bring both knowledge and technology. Northeastern University commenced furthering their university-industry collaboration in the field of life sciences after having achieved definitive results in the field of information sciences.

In 2005, Northeastern University established the "Sino-Dutch Biomedical Information Engineering Institute, Northeastern University" as a joint venture with the Neusoft Group, Philips of the Netherlands, and Eindhoven University of Technology. The research area of this independent institute was the biomedical field, and this set the stage for utilizing Neusoft's proven strength in software toward the development of software technology for medical instruments such as MRI, CT scans, etc. The expansion beyond IT into the life sciences further increased the possibilities and the importance of university-industry collaboration.

Not only were human resources with specialized knowledge being developed through the support (funding) from industry to academia, but it also became an important talent pool for the support of Neusoft's future businesses. At the same time, the IT human resource development and building of software parks was also connected to providing the technology and human resources for other players in the software industry. This could be viewed as a type of reverse flow back into "academia" through university-run enterprises, which in turn heightens new possibilities for indirect industrial creation.

Lessons from the Neusoft case

While Neusoft was established as a local university-run enterprise, the percentage of invested ownership held by the university gradually dropped from 27.6% in 1996 to 17.6% in 2011. Neusoft had already begun to participate aggressively in global compe- tition as an independent company by the start of the 21st century. From its inception to its connection with foreign investment from Japan's Alpine, Neusoft was not a common occurrence as a university-run enterprise of the time. Dr. Liu and his team (people) at Northeastern University and their ability to develop the technology (technology) were without a doubt determining factors in procuring the funds (money) from Alpine.

Neusoft, which began as a local university-run enterprise, subsequently utilized their network with Japan's Alpine Electronics, Inc. and were able to introduce their own in-house developed software into global car audio facilities. Because of this, Neu- soft not only overcame difficulties in funding and market development common to ear- ly stage ventures, but was also able to accumulate the valuable experience of global expansion.

5. Conclusion

The characteristics of university-industry collaboration in China from 1980's to 2000's are summarized as the research conclusions of this paper as follows. University-industry collaboration in China until the 1990's was characterized by the mainstream expansion of university-run enterprises representative of direct

management by the universities. However, due to the economic reforms implemented after the start of the 21st century, the direct collaboration between universities and university-run enterprises was discarded, and university-run enterprises took the form of university-owned enterprises.

Furthermore, the position of universities that were involved in university-industry collaboration transitioned from the former university-run enterprise format where universities themselves participated directly in the markets to the format of university-founded science parks where functions of incubation, technology transfer, and patent acquisition were emphasized.

In addition, indirect operation of the university-owned enterprises within the university-founded science parks became the standard, and the degree of exposure to market principles was expanded significantly. The university-industry collaboration model of the 1990's, in which university-run enterprises were established and mainly transferred technology to state-owned enterprises, shifted to a model in the 21st century which saw greatly expanded transfer of technology to private enterprises and the operation of university-founded science parks along with the surviving university-run enterprises.

The questions posed in this paper are essentially the following: "Why was it possible for China's universities to play the role of industrial creation through university-industry collaboration?" and "How did that role change and why did those changes occur?"

First, the fulfillment of the industrial creation role of universities through university-industry collaboration was due to their assuming this role in place of enterprises in a period when markets in China were inadequate, as well as the necessity for them to bear the associated risk. The stringent financial circumstances for universities in China from the 1980's through the 1990's, wherein universities had to obtain funding on their own, also certainly played a role. One additional factor is a market environment in China that had almost no means of receiving technology, thus making it necessary for the university's technology experts themselves to proactively engage in the commercialization of technology. Due to the insufficient development of markets, universities that exist outside of the markets needed to act as proxies by supplementing a portion of the market functions and playing a partial role in industrial creation. It may also be said that this proactive undertaking by universities fulfilled a specific role in the catch up development model of China's economy.

Next, the following question is addressed: "How did the industrial creation role of universities change and why did those changes occur?" In the China of the 1980's to the 1990's, universities fulfilled roles of proactively creating enterprises and supplementing for themselves the imperfect nature of the market's industrial creation function as institutions of entrepreneurship. After the start of the 21st century, however, the circumstances relating to university-industry collaboration began to

change little by little. Universities separated themselves from the former state of university-industry collaboration where enterprises had been established by the universities, and began to indirectly manage the university-run enterprises through holding companies. In this manner, the university-run enterprises were transformed into university-owned enterprises. Furthermore, universities changed their former tendency to industrialize the technology on their own, and developed the tendency to look externally for the transfer of technology and provision of technology-related services, and shifted their focus to university-industry collaboration through the incubation function provided by university-founded science parks.

Northeastern University and Neusoft fulfilled the roles of nationwide pioneers as their university-founded enterprise brought new possibilities to Shenyang, a place that no one had imagined suitable for the software industry. Neusoft, which grew from a local university-run enterprise into a global corporation, suggests to us the harmonization of "people", "capital", "property (technology)," and "information (network)." In particular, this case shows the development of "people" to support the future of the enterprise and a management technique with a global vision that reaches beyond the local perspective.

Nonetheless, there are a variety of issues remaining with university-industry collaboration in China. Among these are issues such as the regional imbalance of university-industry collaboration progress and the difficulty in diffusing a standardized method of university-industry collaboration through the entire country. Observation of the development process of university-run industry occurring in China's universities indicates that universities will surely continue to fulfill an important role in China's market in years to come.

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