Innovation Feedback: Interactive Development in Research Universities and Their Science Parks

Meng Mei
Professor, Tsinghua University
Managing Director, Tsinghua Science Park

Since early 1990s, university-owed science parks are getting more and more popular in China. They have received a lot of government supports and draw more and more industrial attention. Gradually, the advantages of university-owed science parks are recognized by the public. From the research universities’ point of view, what is the motivation for them to develop these science parks? By introducing and analyzing the experience and practice in Tsinghua University and Tsinghua Science Park (THSP), this paper tries to study the benefits which universities can gain from their science parks and how the both entities can develop interactively.

I. Evolution of the functions of research universities

The development mode of knowledge-based economy emerging in recent years has changed people’s understanding about knowledge and technology. Having realized “Science and Technology is the first Productivity”, the Chinese government urges research universities to make more direct contributions to “create wealth” while performing their traditional functions of knowledge repository, education and research. Against the background of the development of the knowledge-based economy, universities, especially research universities, play more and more important and irreplaceable roles in national and regional economic development, social progress and technological innovation. According to Academician Zhou Ji, Minister of the Ministry of Education of China, the functions of high-quality universities cover firstly fostering top-tier talent for innovation, secondly performing scientific and technological research, and thirdly making significant contributions to social services, especially the technology transfer and the commercialization of their R&D achievements.

Making use of its knowledge accumulation, universities get themselves involved directly in the economic development by playing two basic roles: (i) the sources of hi-tech innovation radiation and (ii) the incubators of hi-tech start-up companies.

First, as the sources of hi-tech innovation radiation, universities actively and directly promote their R&D achievements to industries and enterprises by IP licensing and technology transferring, and boost the development of national and regional economy through helping these enterprises’ digestion, absorption and utilization of the high and new technologies.

Second, as the incubators of hi-tech start-up companies, taking the advantage of their high density of knowledge and talent, universities have directly launched their own technology companies and involved in the operation and management of these companies so as to support the economic development by implementing their innovation incubation capability on their own initiative. Or, attracted by universities’ resources, start-ups sponsored by other parties also love to be incubated in university science park facilities. By doing this, the risk of new start-ups can be minimized.

Given the above two situations, we can see the diffusion of technologies and knowledge from universities to society and industries by means of integration with economy, namely, the process of technology transfer from universities.
II. The emergence and development of university owed science parks

For research universities to recognize that their functions of technology transfer and commercialization of their hi-tech R&D achievements are as important as their education and research functions, not only is it important that they conduct to transfer their research achievements to industries or set up technology-derived businesses by themselves, but also is it more important that they shall take part in the development of regional innovation systems or local innovation networks. The platform of the innovation networks is mainly in the form of university-run science parks. Such innovation platforms incubate hi-tech start-ups and facilitate the technological innovations more actively by providing them infrastructures and value-added services, creating a favorable environment of resource gathering and open-minded atmosphere of innovation culture.

Universities in China have stepped upon a new stage of technology transfer by founding or participating in the development of university science parks. Chinese university science parks have become a platform of technological innovation and technology transfer by trying to create a “silicon valley” environment in a limited range with Chinese characteristics. They play an active driving role in the formation of regional innovation systems and the development of hi-tech enterprises by developing an innovation environment, fostering entrepreneurial talent, incubating technology start-ups and facilitating technology transfers.

University owed science parks in China originated in the early 1990s, grew in the middle of the 1990s and enjoyed a booming development at the turn of the 21st Century. In 2001, the Ministry of Science and Technology (MoST) and the Ministry of Education (MoE) appointed 22 university science parks including Tsinghua Science Park as the “National University Science Parks” for the first time. In 2002, another 21 national university science parks were launched. At present, there are more than 43 national university science parks in China, which associated with 104 universities and research institutes. By the end of October 2002, the 43 national university science parks had absorbed a total investment of RMB 29.7 billion. Incubators being put into service covered a total area of 2.27 million square meters. 5,500 enterprises, among which 2,300 enterprises were under incubating, stayed in these 43 university science parks. 920 enterprises have graduated. The enterprises under incubating in the parks had commercialized more than 1,860 high-level R&D achievements, obtained 1,923 patents, developed 4,116 new products, attracted over 1,300 returned overseas scholars who wanted to start their businesses in China, and created around 100,000 employment opportunities.

As the only Class-A National University Park awarded by the Ministry of Science and Technology and the Ministry of Education, Tsinghua Science Park typically demonstrates the great significance of technology transfer and innovation systems by linking universities and industries.

Established in 1994, Tsinghua Science Park is located at the southeast side of Tsinghua University, enjoying a strategic location in the center location of Zhongguancun National Hi-Tech Zone. It covers an area of 25 hectares, with 690,000 square meters of planned floorage, among which 350,000 square meters have been completed. It is estimated that the whole construction will be finished by the end of 2005.

After 10 years of development, Tsinghua Science Park has created an environment to facilitate technology transfer and a culture to foster innovation and entrepreneurship, and has become an important platform of Tsinghua University to carry out its mission to serve the society. As an extension of the social service functions of Tsinghua University, Tsinghua Science Park devotes to providing the development of office space and excellent services for start-up incubation, hi-tech research and development, innovation talent cultivation, and technology transfer to satisfy diverse needs from the different client groups of enterprises. The park not only has the first-
class International Exchange Center for Science & Technology, the dining and living services and various facilities for recreation at leisure, but also supplies professional property management and customized business services to the enterprises. And even more importantly, we significantly enhances the value-added services to the enterprises. In order to facilitate a better and faster development of the enterprises in the park, Tsinghua Science Park made a big investment commitment in launching a comprehensive innovation value-added service systems to integrate the resources from the government, universities, industries and overseas to create a supporting platform in the park for the inhabited companies. It will attract more capital, technologies, talent, business partnerships, and even more government attention to flow into our park, which will finally benefit the companies in the park to help them establish the industrial value chain, and minimize the risk of VC investment in the technology start-ups.

Supported by the value-added service system, Tsinghua Science Park takes full advantage of “Cluster Effect” and “Value-chain Effect” created by the inhabited companies and resources attracted by Tsinghua. This makes THSP to become an enriched habitat of technological innovation and entrepreneurial resources. By enhancing “Cluster Effect”, our park attracts more outstanding innovative technologies and entrepreneurs to gather here, and thus to further develop THSP’s capacities of continuous innovation, entrepreneurship, radiation of science park management system and international competition.

At present, three of seven Tsinghua-related listed hi-tech companies, which are Tongfang, Unisplendour and Chengzhi, inhabit in the park. There are also many state-appointed and ministry-appointed engineering research centers, which cover engineering domains, such as CD, CAD, LCD and LED. There are several multinational companies’ R&D institutes and engineering centers in THSP, including SUN, Schlumberger, P&G and NEC, etc. In addition, Tsinghua University’s administration offices and function departments which are in charge of Tsinghua’s technology transfer set up their operations in THSP, such as Beijing-Tsinghua Industry Development Research Institute, Hebei-Tsinghua Development Research Institute, Office of IP Licensing and Department of Science and Technology Development, etc.

Now, under the strategy of Internationalization, THSP are gaining more and more reputation in Silicon Valley. There are many interactive activities between THSP and SV. Realized the special values and resources in THSP, more and more Silicon Valley based companies set up their Chinese operations in our park, including many large companies, such as SUN, Veritas and Broadcom, and small or growth companies as well, like Spreadtrum, Legend Silicon, Servgate, Zylogic, Analogix, Exavio and EPIN, etc. These hi-tech companies are all backed by famous Silicon Valley VCs, for instance NEA, ComVenture, DCM, Intel, UMC, etc. They all experience the special values to help them grow in China. On June 22 of 2004, 20 top-tier VC firms from Silicon Valley consisted of a delegation sponsored by Silicon Valley Bank, visited Tsinghua Science Park to learn our experience and practice of how Tsinghua fulfill its commitment in technology innovation and entrepreneurship. The Case Study III will show how a SV based hi-tech firm established the win-win relationship with Tsinghua University and our science park.

Today, a comprehensive innovation clusters combined with value-chain of education, research and industry have formed in our park, which include the start-up incubators cluster, the technology R&D institutes cluster, the university-owned hi-tech businesses cluster, the professional education and training cluster, the service agencies cluster, and the fundamental and supporting service cluster, etc. The park has housed more than 400 technology enterprises and created around 20,000 opportunities of employment. In 2003, the total business revenue of the companies in our park reached RMB 14.2 billion.

At the same time, on the basis of the cooperation with the local governments, Tsinghua Science Park has established several satellite science parks and industrial bases at
different geophysical location of China to radiate our technologies, information, management experience and other resources from central park to remote locations. To local government agencies, they welcome us because they believe that these parks will promote the development of regional economy; to the companies inhabited in our park, these remote locations will help them to leverage more government support, more partnership and more market penetration opportunities. These parks are: Zhuhai of Guangdong Province to cover South China, Nanchang of Jiangxi Province to cover Central China, Xi’an and Xianyang of Shaanxi Province to cover Northwest China, Kunshan of Jiangsu Province to cover East China, Langfang of Hebei Province and Mentougou of Beijing which are all close to our main site to reserve as the extension area for main park. By layout this parks network infrastructure, a value chain linking R&D, incubation and industrialization from up-stream to down-stream, and a regional interactive networking framework have been formed.

III. Innovation Interactions between University Owed Science Parks and Research Universities

In the THSP innovation system (or “innovation network”), enterprises are the main enablers of implementing commercialization of technology innovation. Universities and R&D institutes are the principal innovation resources since they can provide the productive elements, such as knowledge, technology, talent, and information, etc. University science parks become a platform of innovation network by aggregating resources, providing infrastructure, creating and supporting an innovation atmosphere.

As the platform of innovation system, university science parks have shortened the spatial distance between the enterprises as the main enablers of innovation commercialization and the research universities as the key resources of innovation. By integrating all resources needed for innovation, providing high-quality services required by the growth of enterprises and creating a cultural atmosphere encouraging innovation, university science parks can promote the technology innovation of the enterprises effectively. In the mean time, university science parks and research universities can also achieve interactive development through these technology and commercial innovation activities.

1. Transferring original technologies from universities to industries, to fulfill the universities’ functions to serve the society

University science parks are located closely to the universities which they are natively from. The close location is the key to help utilize the advantages of native affinity between the universities’ technology, industry and academic departments, and to continuously accelerate the speed of technology transfer and increase the rate of success. Particularly, for those projects of technology-intensive and multi-disciplinary hi-tech achievements, companies in the parks enjoy the remarkable advantages of shortening development cycle, conveniently organizing HR and fast transferring technologies. Therefore, the original purpose of university science parks is to provide the beneficial opportunities of development to university-based technology enterprises and to help research universities performing better their social service functions.

Case Study I The Large Container Examination System is China National “Sixth 5-year Plan” research project undertook and accomplished by Tsinghua University. The research result of the project has been transferred to commercial use through the effort and investment of Tongfang, a Tsinghua owed public listed company, whose HQ is in Tsinghua Science Park. The output is a hi-tech application system having a core of radiation imaging technology which integrating with electronic, computer, image processing, control, and precision machinery technology. A new company, NucTech, was set up for dedicating the development of this system by the technical supporting from Engineering Physics Department of Tsinghua University. By far, 40 sets of NucTech systems have been installed in China Custom and played an extremely important role in fighting against smuggling. By the end of 2003, 51 export
contracts of Nuctech systems, with a total value about 1 billion RMB yuan, had been signed. The products were sold to 14 countries and regions throughout five continents. Over the years, Nuctech sub-contracted tens-of-millions-yuan’s project to Tsinghua University for funding further fundamental research and development. As a result, a series of products, such as the airplane and railway container and vehicle examination system, the electron beam mail sterilization system and the radioactive material inspection system were developed successively, which deepened the development of the industrialization of University’s R&D achievement and made another leap of technology transfer.

2. Introducing cutting-edge technologies to expand the academic development of universities under the orientation of the national interest requirements

University science parks pay close attention to the requirements of the state macro economy development, the society and the market, and actively facilitate the transfer of foreign cutting-edge technologies to China in addition to the transfer of universities’ technology achievements which have independent intellectual property rights. THSP tries hard to build channels for domestic, multinational and overseas companies to connect each other. The parks also provide all-round services for the introduction, adaptation and upgrading of the introduced foreign advanced technologies. The domestic and foreign hi-tech achievements in the parks can comprise each other to meet the specific requirements of the local markets. And the foreign technologies and the key academic disciplines of the universities may complement each other to accelerate the academic development of universities. In addition, the effort from THSP in this area also helps foreign companies to find out the right partners to penetrate local market.

_Case Study II_ As a company founded by Tsinghua alumni, Koretide, with its founders who used to work for Microsoft and Netscape, has its business goal to develop the new embedded network operation systems. Not only does the company stay in our Returned Overseas Students Start-ups Incubator, but also our science park is one of its major shareholders. Their operation systems, Elastos v1.0 and v1.1, were released in 2003. During the company is developing its embedded operation systems products to meet the market requirement, at the same time, Tsinghua University established a joint research lab with Koretide: “Operation System and Middleware Technology Research Center”, to take the university’s academic advantages of building a platform for innovation to benefit the both parties mutually. For Koretide, they can access university’s academic resource and for Tsinghua, it can gain the company’s commercial experience. The center invited the founder and CTO from Koretide to lead the research project, from an academic point of view, to develop the next generation operation system in this center, aiming at being the top player in the realm of infrastructure software industry. The center’s academic achievement will become the potential products of Koretide in the future.

_Case Study III_ Inhabited in Tsinghua Returned Overseas Students’ Start-ups Incubator, Zylogic Semiconductor Corporation is also a Silicon Valley based company which has the state-of-art CSoC [Configurable System-on-Chip] technology. Although the technology was originally developed by another Silicon Valley based company which had burned over 50 million USD to develop its great products and technologies, that company faced a huge challenge that they could not find any large potential customers in USA. Zylogic team has the great experience to understand the value of this technology and the market of China. They realized that this CSoC has the large volume requirement for Chinese manufactures in industrial control application, such as PLC and invertors, and the current solutions for these vendors are very expensive and all of the chips are relied on importing. Meanwhile, regarding that the Chinese government proposed a leap of development of IC and chip manufacturing in the middle-long term plan of technology development, Tsinghua Science Park and Zylogic team all realized this is a great opportunity to introduce this cutting-edge technology timely to China. With IP
licensing from that original technology company, TSHP and UMC Capital jointly founded Zylogic. That means, from Day One, Zylogic not only has a product and a market, but also would it have a technology platform to conduct further product development. Today, Zylogic already has a very good customer base and start to generate revenue.

On the other hand, based on Zylogic CSoC technology and its products, Tsinghua Science Park launched an incubator specialized in IC design to provide a supporting platform for the enterprise’s innovations and the university’s research and development. The introduction of the technology enabled Research Institute Information Technology (RIIT) of Tsinghua University to fill the research subject blank in this field and possess one more world-class research capability rapidly.

3. Enhancing two-way interactive development system to robust the universities’ R&D capability by academic-industrial combination

University science parks shall attract domestic and international large companies to set up R&D institutes in the park or establish joint R&D facilities and engineering centers in the parks together with the universities. On the one hand, these industrial R&D institutes can involve teachers and students from the universities into their projects by 7X24 mode, and rely on the technologies and intelligence of the universities to accomplish major technology breakthrough; on the other hand, they constantly provide universities research projects with funding to improve the research ability and education quality, to facilitate the linkage between the universities’ research and the market, and to create a benign cycle of universities’ research activities, enterprises’ demands, technological development and socioeconomic development.

Tsinghua Science Park hosts SUN China Engineering Research Institution, NEC Research China, and the R&D centers of P&G and Schlumberger, etc. The “Cluster Effect” of multinational companies’ R&D centers is forming. These R&D institutes have developed and maintained very close joint research relationship with the respective schools and departments of Tsinghua University, which expands the university’s research domain. For instance, SUN cooperates with Software College of Tsinghua University; Schlumberger cooperates with Department of Chemistry, Department of Biology, Department of Material Engineering, Department of Mechanical Engineering and Department of Hydropower, etc.; P&G has collaboration with Department of Chemical Engineering, Department of Environmental Engineering and Department of Precision Instrument, etc. And the Analysis and Test Center of Tsinghua University and the Analysis Laboratory of Material Department was jointly established by THSP and Tsinghua University.

Last, university science parks are not only the platforms of the innovation network of enterprise technologies, but also one of the assistant platforms of the development strategy of research universities. On the one hand, this assistant platform facilitates the technology transfer from universities to industry, and promotes the universities to carry out their social service functions; on the other hand, it makes substantial contributions to the development of academic disciplines and research of the universities by undertaking technology innovations and forms a mechanism of positive interaction to ensure the vitality and sustainability of research universities and university science parks.