Chapter Five

Policy Debate on Research in Universities in China

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Introduction

China is advancing and changing rapidly in many areas, one of which is the development of the higher education system. There is ongoing debate on how universities could advantageously conduct their research in conjunction with their teaching activities, and especially on laying the foundations of high-tech companies and science parks related to universities. The lessons learned from experience—and the successes thereof—are reflected in China's endeavors to seek suitable methods of further development.

An Overview of the Reforms and Development in Higher Education in China Since the 1990s

As from the beginning of the 1990s the development of the higher education system in China witnessed two stages, from the early 1990s to 1998 and thereafter from 1998 to the beginning of the twenty-first century. Though linked to each other in several ways, each stage has its own characteristics.

From the early 1990s to 1998, the Ministry of Education mapped out the line of the development of higher education in China according to "The Outline of Educational Reforms and Development in China" (MOE, 1993). From the late 1980s, the ministry assigned a special group to draw up this outline based on its own investigations, which was officially approved in February 1993 by the Central Committee of the CPC and the State Council. This stage was characterized by the ministry's strict control over the scale of the development in various universities, including the size of enrollment for both undergraduates and postgraduates, with the explicit stipulation that universities should place emphasis on overall reforms and the *enhancement of quality*. The reforms and development of this stage may be summarized as follows:

1. The aim was to have strict control over the total quantity of college enrollment. The aforementioned "Outline" stipulated that the total number of students of

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universities and other higher education institutes (HEIs) should be about 6,300,000 and the entrance rate for those around the 18–21 age group was expected to be 8 percent; later the total number of students was revised to approximately 7,300,000. In 1998, the actual total enrollment of college students was 6,230,900.

2. From the early 1990s, a series of reforms in HEI were carried out, including administrative reforms, teaching reforms, tuition reforms, and the promotion of private and Sino-foreign joint institutions of higher learning. These have been full-scale and in-depth reforms with far-reaching effects. For instance, colleges began to charge tuition fees in 1993 for the first time since the founding of the People's Republic of China (PRC). Initially this happened at two universities, South-Eastern University and Shanghai Foreign Language College, then smoothly extended to all Chinese higher education institutes (HEIs). Another example is the promulgation of the "Interim Regulations" of the People's Republic of China on Chinese-Foreign Co-operation in Running Schools in 1995. The higher education institutes founded by nongovernmental organizations (NGOs) and private sectors were also established at this period.
3. The implementation of "Project 211" took place in 1995. It was the Chinese government's new endeavor that aimed at strengthening about 100 universities and key disciplinary areas, put forward as a national priority for the twenty-first century. Included in the project were 98 institutions of higher learning. Universities with a relatively higher level of research capacity were and are still all supported by this project. Universities in western China are also taken into consideration. The funding required for "Project 211" is generated through a cofinancing mechanism involving the state, the local governments, and higher education institutions concerned. Investment in the project will total 10,894 billion RMB, of which 2,755 billion will come from the central government, and the rest will be raised by the local governments and the universities involved. Project 211 funds a total of 602 research programs of key disciplinary areas plus some public service items like digital libraries connecting key universities, Chinese Education and Research Networks. The implementation of Project 211 plays an important role in upgrading the academic level of the universities concerned.
4. Project 211 also provides an opportunity to promote cooperation between universities and local governments concerned in their joint effort to reform the administrative setup of institutions of higher learning. It is for this reason that the Ministry of Education (MOE) has put forward a policy calling on the parties concerned to pool their efforts and build up the activities of universities at the academic level.

Reforms carried out at this stage were stable, with both the teaching quality and academic atmosphere exhibiting marked improvement. The major problem was that the state funding for higher education was far from sufficient, and MOE was criticized for its "overstrict control" over the scale of higher education development, and its "overcentralized" administration over universities. Some even branded the ministry as "the last stronghold of planned economy in China."

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Since 1998 China's higher education system has been taking considerable strides. Madam Chen Zhili, the new education minister, presided over the drawing up of "The Action Plan of the Revitalization of China's Education to Meet the Needs of the 21st Century" (1999), which was approved by the State Council in January 1999. And the Ministry of Education began to focus its attention on the implementation of the "Scheme for Trans-Century Education Reforms and Development" as detailed in the "Action Plan." Development of higher education at this stage is characterized by what follows:

1. A drastic increase in the total quantity of college enrollment. In 1999 the Science and Education Leading Group of the central government decided to increase the size of college enrollment (National Centre for Education Development Research, 2002). As a result of the continuous increase from 1999 to 2004, the total number of college students in 2004 exceeded 20 million, making the system the largest in the world. The gross enrollment ratio (GER) had exceeded 19 percent (see figure 5.1).
2. At this stage, university administration reforms have been basically accomplished, and major changes have been made in the former system of practices during the period of planned economy, in which universities were under the administration of related ministries. In place of the old system, a two-level administrative system has been established, which involves the participation of both the central government and provincial governments concerned, with the administration at the provincial level taking major responsibilities. More than 900 universities have been involved in the cooperation, unification, or merger

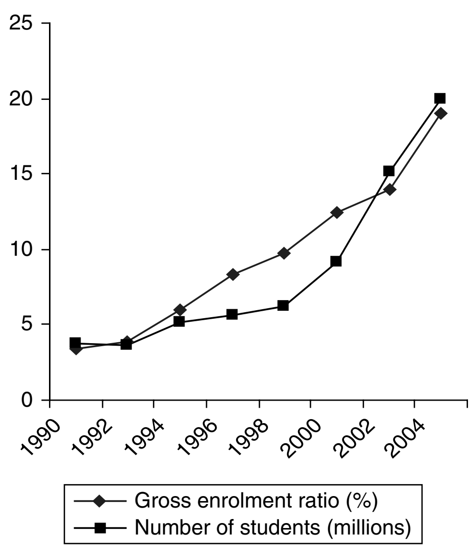

Figure 5.1 Change in the gross enrollment ratio (GER) and the total number of students (1990–2004)

Source: MOE, 2004.

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programs of various forms. As a result, a number of "jumbo-sized" comprehensive universities have been established. For instance, Jilin University, located in Changchun City, Jilin Province, is currently the largest university in China. It is a combination of 7 colleges, with a current enrollment of 60,000 students, and approximately 20,000 faculty members.

3. More money is to be invested in higher education. On the hundredth anniversary of Peking University in May 1998, the then president Jiang Zemin announced that China would build the best first-class universities in the world (Jiang Zhe Ming, 1998). After that, the Ministry of Education embarked on the "985 Project," named after the date of President Jiang's announcement. Accordingly, nine "first-echelon" universities, including Peking University and Tsinghua University, obtained intensive support, followed by more than 20 "second-echelon" ones aimed at becoming "higher-level" universities of the world. Of the 14,469 billion RMB appropriated by central finance in fiscal years 1999–2002 and used for carrying out The Action Plan for Vitalizing Education of the twenty-first century, 12.612 billion RMB was allocated to those universities mentioned above (MOE, 2002).
4. Social services of higher education, like scientific research and technology transfer, are active. The money put into scientific research in universities in 2004 was five times more than that of 1996 (Zhou Ji, 2004).
5. Along with the rapid expansion of the scale of higher education, some new challenges appear:

   i. The development of vocational education and elementary education in rural areas is relatively slow with respect to the requirement of economic and social development in China.
   ii. Some administrative problems result from the expansion and reorganization of the institutes of higher learning. Coupled with inadequacy of teaching staff and reduction of per capita money for students, the quality of higher education has been a great concern for the nation as a whole.
   iii. College graduates' employment has become a "hot topic." In recent years the vice-premier would preside over a special meeting to discuss this topic. In 2004 the official data for college gradates' employment was about 75 percent.
   iv. Some universities, irrespective of their present conditions, compete for aiming at becoming first-class or prestigious universities of the world so much so that they blindly invest in building ambitious campuses and set up some new disciplines that duplicate existing programs.

All circles of society have mixed judgments on the rapid expansion and merger of universities after 1999. The pressures and impetus for expanding higher education come mainly from domestic political, economic, social, and cultural considerations, sometimes also from international influences, especially those aid-providing countries and influential international organizations, like the World Bank (WB) and the Organisation for Economic Co-operation and Development (OECD). The factors mentioned above partly contribute to the wave of rapid expansion of higher education.

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However, this chapter holds that the political willingness and instinctive decisions of those in charge are the decisive factors. It takes time to assess such a far-reaching decision, just as an old Chinese saying goes, "It takes ten years to grow trees but a hundred years to rear people."

This overview serves as background information for further discussion of the policy concerning the development of science and technology in Chinese institutions of higher learning.

Some Definitions

As far as universities are concerned, their primary goal is to cultivate talents, which entails not only *teaching* but also many other activities including *research* work. Apart from the cultivation of talents, universities should also contribute to scientific progress and provide the society with some direct services. All this cannot be separated from research work. Research mentioned here includes research and development (R&D). According to the definition given by UNESCO, "science includes natural science and social science." Restricted by its length and the author's knowledge, this chapter mainly deals with the R&D of natural science. According to the definitions given by the Ministry of Science and Technology (MOST) of China, some terms on R&D involved in this chapter are defined as follows (MOST, 2001):

Research and Development (R&D): it refers to the systematic and creative activities (including basic research, application research and development) in the field of science and technology, aiming at increasing the total amount of knowledge and applying the knowledge to creating new applications.

Basic Research: it refers to the experimental or theoretical research aimed to acquire new knowledge about the basic principles, like those revealing basic laws of things, governing phenomena and observable facts, but not aimed at any specific or particular application.

Application Research: it also refers to creative research for acquiring new knowledge, but it aims at a specific target, that is, to explore the possible applications of basic research or the new methods or approaches that may be used to reach a certain goal.

Development: it refers to the systematic work of applying the knowledge acquired from basic research, application research and actual experience, so that (i) new products, materials and devices can be developed, (ii) new techniques, systems and services can be established, and all the above having been developed or established can be substantially improved.

A Summary of the Scientific Research in Chinese Institutions of Higher Learning

Scientific research in Chinese institutions of higher learning falls into three stages: (i) initial and trying stage from 1947 to 1976; (ii) recovery and development stage from 1977 to 1984; and (iii) reform and development stage from 1985 onward.

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In the early 1950s, the Chinese government, following the former Soviet Union model, separated scientific research from universities and set up a separate Chinese Academy of Science. This was why scientific research in universities was weak at that time. After years of effort, in the early 1960s, the scientific research in Chinese institutions of higher learning began to be regulated by the government, which appropriated money on a regular basis. Unfortunately, the Cultural Revolution beginning from 1966 proved to be a disaster to Chinese universities, setting back its scientific research activities severely.

The year 1977 was a transitional year for Chinese institutions of higher learning, when the late Mr. Deng Xiaoping pointed out that universities, especially the key ones, should play an important role in scientific research. After that, universities began to resume their scientific research. In 1981, China began to train its own masters and doctors.

In 1985, the Chinese government started reforms in its systems of science and education. Competition was introduced into the funding mechanism of scientific research, and about 100 national research centers supported financially by the central government were established in universities, which have quickly become the main forces behind nationwide scientific research, especially in the area of basic research. According to the statistics of 2002 (MOE, 2002; MOE, 1999; MOE, 2003a), of all the teaching staff in universities, those who were wholly devoted to scientific research totaled 286,000 (excluding hundreds of thousands of postgraduates), among whom there were 450 academicians, accounting for 33 percent of the total in the whole country. Over the past 2 decades, financial contributions to scientific research in universities has increased considerably, from 590 million in 1985 to 21.9 billion in 2002, an increase of more than 30 times (see figure 5.2). Of the research projects supported by the National Foundation of Natural Science, 70 percent are taken up by universities, and of national key research projects, 60 percent by universities, which also take up 30 percent of the national high-tech research programs. Of the three National Science Rewards, universities win half of the National Science Reward, one-third of the National Invention Reward, and one-fourth of the National High-Tech Progress Reward. Furthermore, they account for over 60 percent of the total research papers published at home and abroad. In terms of social science, universities are a major force. Take the year 2000 as an example (MOE, 2002).

Of the 23,446 research items of social science, universities were responsible for 20,301, about 86.5 percent of the total, with a financial investment amounting to 340 million. All the above demonstrates that universities gradually became a major force in national scientific research, particularly in basic research.

According to the data of "Bulletin of Statistics on Chinese Education in 2003" issued by the Ministry of Education (MOE, 2004), there are altogether 2,210 ordinary universities and institutions of higher learning for adults in China in 2003, of which 1,552 are ordinary universities. Among them, 644 can confer a bachelor's degree, 407 a master's degree, and 260 a doctor's degree. The universities that can train postgraduates, especially doctoral candidates, have to be more active in their research work.

Most of the research work of natural science in universities of China is concentrated in about 60 institutions, which have gathered approximately 70 percent of graduates and 90 percent of doctoral candidates as well as over 85 percent of doctoral

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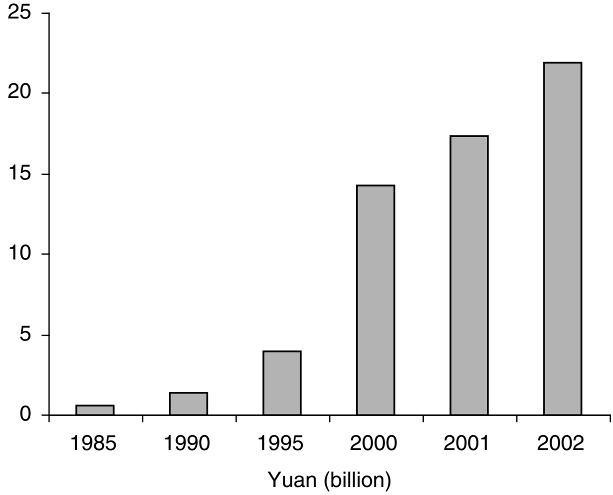

Figure 5.2 Increase of R&D expenditure in universities (1985–2002) (billion Yuan)
Source: MOE, 2002.

degree programs. With over 70 percent of the total research fund contributions allocated, 96 percent of national laboratories and engineering centers have been established, which stands to say that they are the main forces of scientific research work. In these universities there are usually graduate schools, and the ratio of undergraduates to postgraduates exceeds 1:4.

The Ministry of Education in China has not adopted the category of "Research University" yet. Generally, the research university, as a type of university, should have objective standards of evaluation. Combined with the general situation at the international level, and in accordance with the comments of Zhao Xin-Ping (2003), current deputy minister of Education in charge of scientific and technological work in universities, the evaluating indicators to identify research-oriented university includes the following:

1. Sufficient scientific and technological research funds should be available, and the longitudinal research funds coming from different levels of governments should not be lower than the horizontal scientific and technological development funds coming from industries and the private sectors. In the meantime, the contribution of the scientific and technological funds to the operation of universities can be equivalent to the education appropriation granted to them by the government. This contribution refers to the part of the fund that has been transformed into school-fixed assets and staff costs, generally about 30 percent of the total fund.
2. Teachers' scientific and technological workloads should be equivalent to their teaching ones, or the number of teachers whose work is converted to teaching and research should be similar.
3. The ratio of undergraduates to postgraduates should be about 2:1.

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4. Innovative scientific and technological achievements that are adequate in number and internationally competitive should be continuously created. As a matter of fact, these can only be regarded as some denotative indicators. For a research university, the conception and idea of running a school is more important. It is necessary to have the concept of setting up a real high-level research university, the idea of having its own superiority and features, and the establishment of operational mechanism of veritable research universities.

China has identified about 20 research-oriented universities, including schools of "the first echelon" and "the second echelon" determined upon the implementation of Project 985 by the Ministry of Education.

Along with the development of scientific research work in universities, the following two policy debates remain heated.

First is the relationship between scientific research and teaching in universities. How to deal with the relationship between teaching and scientific research in universities is a hot issue discussed frequently. The focus of the debate includes: Is scientific research a means of training people or an essential task of the universities? Is there any conflict between scientific research and teaching in universities? Do all of the universities need to do and have the making of scientific research?

With the development of "knowledge-based economy," scientific research in universities is playing an increasingly important role in personnel training, knowledge creation, and social service. The trend that scientific and technological activities have gradually become one of the important ways of personnel training in high-level universities suggests that the society has put forward new requirements for personnel qualifications. With the increase in the number of postgraduates in universities, more than ever, the training of these students cannot do without scientific research activities. In addition, even for the education of undergraduates, due to the rapid development of knowledge, the diverse purposes for enrollment, the reform of problem-centered teaching methodology, and the continuous improvement of teachers' levels, cannot do without scientific research work. However, for certain teachers, a lot of scientific and technological activities will indeed have influence on his/her teaching. Since teachers are more attracted by scientific research, they are usually inclined to *focus* on scientific research and *neglect* teaching. The vitality of scientific research in schools does not naturally improve the quality of teaching. The conflict between teaching and scientific research is more outstanding in universities, particularly for the developing countries, for the following reasons:

1. Compared with the output of scientific research in universities, the country's input to them is relatively small. In 2000, the R&D expenses of state-owned scientific research institutes with independent accounting was 25.82 billion RMB with an increase of 8.3 percent compared with 2003, covering 28.8 percent of the total domestic R&D expenses; the expense in universities was 7.66 billion RMB with an increase of 20.9 percent, covering 8.6 percent of the total; the expenses of different types of enterprises was 54.06 billion RMB with an increase of 23.9 percent, covering 60.3 percent of the total; other expenses was 2.06 billion RMB, covering 2.3 percent of the total. About half of the

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scientific research fund in universities comes from the government, while the other half is collected from enterprises (Bulletin, 2000).

2. It is difficult to collect "free funds" for research. The departments concerned mainly introduce project-competitive modes to support scientific research. This marks the tendency of reform; however, not only will the fact that all the projects should obtain funds by means of competition make teachers' work more burdensome, but also this kind of competitive culture will also have an impact on some traditional jobs and the openness of teaching activities.
3. Compared with scientific research institutes, universities have special advantages such as multidisciplinary and interdisciplinary research, concentrated talents, much new blood, and "free and loose" academic environment. The advantage of universities is based on personnel training and basic scientific research; however, in a developing country, the input to basic research is small, outstanding talents cannot be maintained, and the research base is relatively instable, so it will take time to gradually improve the mechanism and research environment. Considering the effect and urgent need of the country, universities are required to carry out scientific research of various kinds, including cooperation with enterprises. As a result, the majority of the scientific research funds of universities is unstable, although research results must be produced in a very short period of time.

In a developing country such as China, a great deal of scientific research work at the current stage falls on applied research and technology transformation. Take the year 2000 as an example (Bulletin, 2000): of the total expense 89.6 billion RMB of Research and Development (R&D), the expenses of basic research was 4.67 billion RMB, covering about 5.2 percent; the expenses of applied research was 15.21 billion RMB, covering about 17 percent; and the expenses of experiment and development was 69.72 billion RMB, covering about 77.8 percent. Although the expense of basic research was increased by 1.22 billion RMB with a rate of 35.3 percent, the funding of basic research is usually small.

Universities have experienced some difficulties in fields such as applied research and technology transformation: (i) There is difficulty in reorganizing the work team. It takes great efforts to organize the research fellows of different teaching and research sections of the same department, or of different departments, to work jointly on a bigger scientific research project, and the team is easy to dissolve; (ii) Sharing resources is another difficulty. Repeated investment occurs in different universities, and the utilization ratio of facilities is low; (iii) Universities are not familiar with the transformation of scientific research achievements and have no advantages. However, the researchers themselves in China usually are required to do the whole process of technically transforming scientific research achievements, which is necessary to obtain economic support from outside the government fund. The result is the emergence of school-run industries of universities and college and science parks related to universities and colleges (discussed later in this chapter). This increases the complexity of campus management, which influences the balance of teaching and scientific research to some extent. A lot of scientific research is carried out in schools in cooperation with enterprises, sending us a new challenge in the common good of school knowledge and the change of school culture.

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At present, scientific research is getting more and more expensive, and not all of the universities can afford it. As a result, it is thought that many universities might make some "inquiry learning" and experimentation, not all of them should do scientific research, especially in the field of natural science. Therefore, the Chinese Ministry of Education has proposed guidelines for the scientific research of universities in the years to come, which can be summarized as follows:

1. *Coexistence of multilevel scientific research*. Focus is on basic research, strengthen technological innovation, promote the technical transfer, and normalize the mechanism and the management of industries and science parks related to universities.

2. *Guidance to different areas*. Take dots (key laboratories), lines (interschool cooperation centers, etc.), and then the whole (schools or regions) into consideration, improve coordination, strengthen priority areas, and facilitate cooperation and communication between universities and research groups.

3. *Facilitating*. The gradual form of a range of high-level universities with stronger scientific and technological strength and international competitive ability should be established, making due contributions to scientific and technological advances, economic construction, social development, and state security.

For a country with imbalanced development and vast territory such as China, such developments by levels in research activities in universities, and emphasis on applied sciences, are wise and realistic choices.

*Second is the debate on the development of high-tech industries and science parks in universiti*es. High-tech industries and science parks in universities bear different implications, but they belong to the same category in the course of development and the problems to be debated will be similar in substance. In China school-run factories in colleges started in 1958, when mass activities of "Great Leap Forward" were carried out. Factories for training purposes were established in some schools to enable the students to practice "on-the-job." These factories were mainly the training base and processing plant of teaching and scientific research instruments, and only a few products were supplied to the community. By the beginning of the 1980s, with the in-depth performance of reform and opening up in China—particularly after the State Council issued a decision concerning the institutional reform of economy, science and technology, and education in 1985 focusing on the combination of science and technology, education and economy—a range of universities, headed by the south-eastern University, Central China University of Science and Technology, and the North-Eastern University, personally and successively established science-park-related universities, in different forms, in order to accelerate industrialization and production of new technologies. This (along with the hope of learning from successful examples of the development of science parks related to universities and high and new technology industrial parks at the international level) resulted in the boom of the novelty of the "Science Park," in which the industrial and science parks are directly initiated by the universities instead of the community. However, limited by the awareness and environment at that time, the first attempt to set up college industries and science parks in China failed, but valuable experience has been accumulated.

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In 1991, Deng Xiaoping, the general designer of Chinese reform and "opening up," wrote an inscription for the High-Technology Scheme, China: "to develop high technology and to realize industrialization." From then onward universities made a second initiation of setting up high-tech industries and science parks related to universities. Universities such as North-Eastern University, Harbin Industrial University, Peking University, Tsinghua University, and Shanghai Jiaotong University began to march toward hi-tech industries and establish science parks related to universities after this period. The establishment of science parks and the initiation of high-tech industries owned or run by higher education institutes obtained the national support of many sides and played a positive role in the industrialization of high and new technologies and the development of the national economy. A lot of influential hi-tech enterprises and business groups were established such as Tsinghua Tongfang Co., Ltd., Neu-alpine Software Co., Ltd., Founder Electronics Co., Ltd., Tsinghua Unisplendour Group, Peking University Resource Group, Tianjin Tiancai Co., Ltd., Shanghai Jiaoda Only Co., Ltd., and Wuhan Central China Numerical Control Co., Ltd.

In August 1999, the Central Committee of the CPC and the State Council held a national conference on technology innovation and issued the decision of the Central Committee of the CPC and the State Council concerning the "Reinforcement of Technology Innovation, the Development of High Technology and the Realization of Industrialization." It stated expressly,

> Universities should give full play to their own advantages of talents, technologies and information, encourage teachers and researchers to enter the development zone of high and new technological industry and work on the commercialization and industrialization of scientific and technological achievements. They should support the development of science parks related to universities, train a range of high and new technological enterprises and business groups with the intensity of knowledge and intellectuals and the advantage of market competition, making closer co-operation between industry, university and research. (MOE, 1998)

The Ministry of Education (MOE) and Ministry of Science and Technology (MOST) jointly facilitated the science parks related to universities at the national level, first selecting the ones (Bulletin, 2000) in Tsinghua University and Peking University as pilot enterprises. One of the important features of the construction of science parks related to universities is the joint effort among (i) government; (ii) industry; (iii) university; (iv) research; and (v) financial capital. Instead of an action carried out by the individual university, the new action of construction of science parks that would be related to universities received great support from the central and local governments in aspects such as infrastructure, capital, and policy, as well as from enterprises and financial communities. Furthermore, the construction of science parks also tries to follow the guidelines of market orientation and is operated in accordance with modern enterprise system, so most of the industrial and science parks exceed the limit of universities. A lot of domestic and foreign corporations are attracted to settle down in the parks and collaborate with universities. At present, science parks related to universities that are completed and some that are still under construction amount to 44, backed by 104 universities.

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Through their painstaking efforts, faculties and scientific research personnel in universities have overcome numerous difficulties and blazed a new trail of developing the high and new technology industry with university-industry-research integration. This is a kind of pioneering undertaking—with Chinese characteristics. The increasing scientific research capability and the rapidly developing scientific and technical industry in Chinese universities have attracted the attention of the whole society. The development of high- and new technological enterprises and science parks has achieved some positive effects:

1. *The enterprises of universities maintain a sound momentum of development* on an increasing scale. Nearly 40 such enterprises of science and technology have been listed in Shanghai, Shenzhen, and Hong Kong stock markets directly or through reverse merger. A number of such enterprises have become renowned at home and abroad, with a very good reputation in society. They are playing an important role in promoting the growth of the national economy and enhancing the adjustment and upgrading of industrial structure. In 2003, the income of university enterprises totalled 82.667 billion RMB (Bulletin, 2004).
2. *They have spurred the development of regional economy* helping to solve many major problems in economic development. For example, the technology of the "efficient filling tower" developed by Tianjin University has been applied to more than 1,000 large- and medium-sized enterprises throughout the country, with the economic benefit amounting to over 500 million RMB.
3. *They have strengthened scientific and technical cooperation* between universities and domestic and overseas enterprises. According to statistics (Ministry of Science and Technology, 2004), by the end of October 2002, the university sci-tech parks had attracted a total social investment of 29.7 billion RMB. The area of incubation parks put into use had amounted to 2.27 million square meters; the number of various research and development institutions to over 1,200 and, enterprises that had moved to 5,500 in number. Nearly 2,300 enterprises were being established and more than 920 had risen up, with 29 of them being listed on the stock market. Totally, 1,860 findings of scientific research above the provincial level had been achieved, with 1,929 having obtained patents and 4,116 new products having been developed. Meanwhile, over 1,300 people who had furthered their study overseas had come back to open their own businesses, providing about 100,000 job opportunities.
4. *They have cultivated qualified all-round talents* with professional knowledge in science and technology and experience in operation and management. The development of sci-tech industry and science parks in universities can help to cultivate talents in two respects. On the one hand, such enterprises and parks provide the environment and platform for business openings, so that people can become experienced in practice. On the other hand, some training courses are provided according to the demand of the market and business, which is beneficial to the cultivation of urgently needed business talents who are specialized in science and technology.
5. *They have promoted the reform of universities*. The development of university science parks has promoted the transfer of scientific findings and the

industrialization of high and new technology. It also enhanced reform of science and technology structure and personnel and allotment mechanism. Universities have adopted humanistic incentive policies to encourage scientific and technological talents to open up businesses in science parks. For example, candidates who have, bachelor's master's, and doctoral degrees are approved to retain their status as students while starting their high and new technology businesses with patented technology or scientific research achievements. They are also encouraged to do so in their spare time or while suspending their schooling. Teachers are also encouraged to transfer their scientific research achievements into products and have a part-time job in high and new technology enterprises or to start their own businesses. Those who open up their businesses are allowed to have corresponding stock shares of technology and management.

However, there are some problems in the development of enterprises owned or run by universities that are embodied in unfavorable property ownership. Other problems are the university's direct undertaking of operation risks, improper management systems, university's overinterference in enterprise administration, and lack of mechanism of "withdrawal" of investment. As a result of these unfavorable mechanisms, these problems are inevitable in the development of enterprises owned or run by universities and are not relatively easy to solve. In November 2001, the General Office of State Council issued the "Guiding Opinions on Pilot Regulation of Management Mechanism in Enterprises Attached to Peking and Tsinghua universities" (General Office of the State Council, 2001), requiring that the structure of university enterprises should be regulated and follow modern enterprise mechanisms. This "Guiding Opinion" is now under implementation and has achieved good results. For example, an assets management corporation has been established in Tsinghua University for the "exercise management of university enterprises."

The hard problem lies in the obvious shock of these enterprises on traditional campus culture. It remains a hot point of discussion on how to look at these changes. As a developing country, China has its market economy at an early stage of development and its scientific and technological forces as well as management talents concentrated in universities. The development of high and new technology enterprises depends on the support of personnel, environment, and scientific research achievements of universities. There is an imperative demand in society for the establishment of enterprises and science parks related to universities. Universities and their faculties also have the enthusiasm to transfer their scientific research achievements to the industry to raise funds. However, it takes a long time for research achievements to transfer, and there also exist risks; therefore, these enterprises first appear in universities, where *two cultures* of different natures coexist: the *original campus culture and values versus new culture and values of enterprises*, whose conflicts will have some impact on the entire university.

The author holds that the achievements of high-tech industries owned by universities and science parks related to universities should be fully affirmed and that some problems like management regulation can be gradually resolved. The development of Tsinghua University and Peking University has proved this. The change of campus culture is the result of the development of the "knowledge economy" and the "knowledge society." In fields such as medicine, computer software, and industrial design, there is an increasingly unclear dividing line between the activities of basic research and establishment of enterprises. Knowledge and wisdom of human beings have become the most important materials required for production. It is more and more difficult to forbid professors to participate in enterprise activities. Therefore, the change of universities is inevitable. What one should do is to try their best to achieve good results in accordance with the trend of the development of human society. The new "knowledge-intensive society" poses new challenges to the *management* of universities. "To meet these challenges, we cannot depend on anything supernatural but on our own exploration and creation in practice" (Wei, 2000).

Zhou Ji (2004) the newly elected minister of Education in 2004 has stressed several times that we "should further emancipate our minds and adhere to the principle of 'active development and regulated management' to promote modern enterprise mechanism." We should promote the positive and rapid development of university enterprises and sci-tech parks toward a new level and a larger scale. It is justified to believe that this is a feasible road for Chinese universities to take in order to "speed up" their development in the "knowledge society."

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