

From village to high-tech powerhouse

Shenzhen is indeed a pot of gold at the end of the rainbow.

Few, if any, cities in the world can boast the kind of dramatic change that Shenzhen has experienced. A fishing village in 1980, it is now a roaring metropolis. In a city of immigrants from all over China who are brimming with confidence and ambition, municipal organizers are converting its economic base from low-end manufacturing to high-tech industry. Expanding ties with neighbouring Hong Kong symbolize the city's prodigious emergence onto the world stage and promise a new chapter in this extraordinary story of growth and development. Shenzhen is a model for governments in developing countries around the world that wish to spur regional economic growth.

Until the late 1970s, Shenzhen was, like the rest of China, part of a strictly planned economy. Then, Deng Xiaoping, reinstated around that time as the head of the Communist Party, launched a series of reforms aimed at opening up the country to more economic growth, especially through ties and trade with foreign countries.

As part of these reforms, he opened up a handful of 'special economic zones', which were able to give tax incentives for foreign-owned companies. They could also open up certain aspects of the market to international trade. Results came immediately and foreign investment poured in.

Shenzhen, in the southern part of the southern province of Guangdong, was the first city granted these privileges. Zhuhai and Shantou, also in Guangdong, Xiamen, in the neighbouring Fujian province, and the island of Hainan also became special economic zones. But none of these took off like Shenzhen. In 1992, Shenzhen's economy was on the same scale as the other four special economic zones, but now its total economy exceeds all of them added together. Now it is six times greater. At RMB 581.36 billion (USD 77.25 billion), its gross domestic product is the fourth highest in China.

Immigrants, ideas and innovation

Zhou Luming, the deputy director general of the city's Bureau of Science, Technology and Information, says one of the advantages

was simply the proximity to Hong Kong, a well-developed centre of international finance. But the main reason was the flood of people who came from all over China, bringing their hopes and dreams with them. Among the city's 12 million inhabitants, only 400,000 are native.

"The passion of people who had been restrained for many years under the planned economy system exploded in this city," says Zhou.

"The immigrants brought new ideas and innovation," adds Lin Xiong, deputy director of the bureau's Planning and Development Department.

During the 1980s, the city made its fortune on low-end manufacturing, as foreign companies were looking for cheap places to manufacture their goods. Shenzhen's economy was growing by 50% a year.

In the 1990s, city officials decided to upgrade their economy by establishing a high-technology infrastructure. They had been spurred by competition from the other special economic zones and a natural desire to produce more profitable, higher-end products. They also now had the economic wherewithal to invest in such technology.

And they had models near at hand. Two telecommunications companies, Huawei Technologies Co., Ltd. and Zhongxing Telecommunication Equipment Co., Ltd. (ZTE), founded in 1988 and 1985, respectively, took off in the early 1990s to become two of the world's largest companies in the field today. The twins of Shenzhen, as Huawei and ZTE have come to be known, together account for some RMB 90 billion in industrial productivity, over 8% of the city's total. ZTE is now rushing to catch up with Huawei. International sales increased nearly 100% over the first half of 2007. The two companies are now creating R&D centres throughout China, as well as overseas in places like India. "When Shenzhen was looking for innovation, these two companies grabbed the chance," says Lin.

From 1992 to 2006, the average annual growth of Shenzhen's high-tech industries increased by a staggering 45%. In 2006, Shenzhen's high-tech production reached RMB 630 billion,

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topping China's other major cities. The city's investment in research and development is some 3.4% of its GDP — far higher than the national percentage of 1.4%.

Unlike most technological innovation that remained in the laboratory in other cities, the market economy system, established by the local government in Shenzhen, saw enterprise there take a dominant role in technological innovation and achieve great commercial success. Despite the blueprint for Shenzhen's high-tech industry being considered a joke 10 years ago, state leaders now laud Shenzhen as a model for other cities across China to follow in developing their high-tech industries.

In contrast to other cities, Shenzhen has adopted a 'reverse innovation model', in which technological innovation is driven by market demand. Enterprises orientate the direction of innovation according to market demand, and then develop their innovations through research collaborations with universities. Using this model, Shenzhen's enterprises have progressed from low-end to high-end innovation.

As an administrator of the city, Shenzhen government plays its role well to meet the demand of the market economy, and creates a relaxed environment to develop enterprises. And as a city that has legislative power, Shenzhen was the first in China to introduce legislation in 1995 that protects intellectual property rights — 'Regulations of Shenzhen Special Economic Zone on the Protection of Technical Secrets of Enterprises'. This made Shenzhen the city that best protects intellectual property rights in China.

But Shenzhen still had a challenging task — to train and establish the required personnel to complete the transformation to a high-tech economy. At that point, the local government believed it was a suitable time to establish its own universities and research institutes.

Fast and efficient solutions

"In order to meet the demands of a city, in terms of culture and education, we had built Shenzhen University and two vocational schools. They had succeeded, but they could not meet the demands of the rapidly growing city," says Zhang Baoquan, director of the Shenzhen Municipal Education Bureau.

Shenzhen's solution to this problem was characteristic of what came to be known as 'Shenzhen speed' and 'Shenzhen efficiency'. Faced with a shortage of high-tech graduates, Shenzhen's leaders decided to invite some of the country's premier research institutions, Peking University, Tsinghua University, Harbin Institute of Technology, and Nankai University, to establish branches. Instead of aiming for new schools that could feed education to the masses like other university towns, they gambled on elite education. Zhou says that Shenzhen's decision to attract universities in the late 1990s was well timed with the decision by those institutions to become more market-orientated. Shenzhen's proven ability to bring products to market made it an attractive partner.

Shenzhen also established many research institutes, such as the Research Institute of Tsinghua University in Shenzhen in 1999, and the Shenzhen Institute of Advanced Science and Technology of the Chinese Academy of Sciences in 2006. It also opened up a 'Virtual University Park' in 1999 to help the universities and other research institutions develop and capitalize on their technological prowess.

This top-down approach, importing high-technology research and education, was unlike anything seen in China, where the emphasis is usually on slow 'normal' development. "This might seem to be against Chinese philosophy, but we dare to do things first," says Zhang.

Zhang says there have been sceptics. "Many people think we could not keep up the standards of these prestigious universities, but history shows we can," he says, referring to the formation of the University of Cambridge by scholars leaving the University of Oxford.

The city has continued to invest in these universities, and this year they have each received three key laboratories, worth RMB 30 million each. In 2006, Shenzhen had 29,000 patents, the second highest number of any city in China. Now Shenzhen has the confidence to build its own comprehensive science and technology university, and construction will soon begin on an RMB 4 billion campus whose doors are set to open in 2010.

Integrating and enhancing assets

The research and human resources in the making, as well as the active investment environment, are likely to attract more companies. The Shenzhen Stock Exchange, the first and still one of only two in China, will be reborn by the end of this year to become a Nasdaq-style exchange that encourages more high-technology start-ups, allowing companies to post shares after just two years of profitability. The move is expected to encourage hundreds of small companies to list.

Shenzhen continues to impress. On a visit in 2005, Premier Wen Jiabao stated that Shenzhen should be a role model for other cities in China.

Policymakers in Hong Kong have also recognized the city's achievements, and this will lead to an entirely new phase in Shenzhen's remarkable growth. In the past, Hong Kong has resisted efforts to forge tighter links with its mainland neighbour. But on May 21, Joseph Wong, Hong Kong's secretary for commerce, industry and technology, and Liu Yingli, Shenzhen's executive vice mayor signed an agreement on technological collaboration called the 'Shenzhen–Hong Kong Innovation Circle'.

The idea behind the collaboration is to integrate the complementary assets of each: Hong Kong's well-established universities and researchers, experience with intellectual property, and international finance know-how with Shenzhen's wealth of entrepreneurs, manufacturing ability, innovation and sheer determination.

Executive Vice Mayor Liu says that the Hong Kong collaboration is the key to the city's future growth. Even greater ties might be in the offing. The idea of a Hong Kong–Shenzhen metropolis was mapped out in a recent report by Bauhinia Foundation Research Centre, a Hong Kong-based think tank closely tied to the government. The report found that facilitating transport and travel between the two cities and increasing financial co-operation would be mutually beneficial and would create a Hong Kong–Shenzhen metropolis, with an area greater than London, to become the third largest in the world by 2020.



Shenzhen's vibrant research environment and the availability of human resources, as well as the active investment environment, is attracting many companies to the city.

A man on a mission



Executive Vice Mayor Liu Yingli of Shenzhen Municipal Government.

Liu Yingli, executive vice mayor of Shenzhen and one of the key innovators behind the development of the city, is a man on a mission.

"Shenzhen is often misunderstood," he says, while explaining the city's rapid development.

We are more than a commercial city providing a factory at the back of the Hong Kong shop-front, he explains. From the beginning, Shenzhen planned a high-tech industry and a university.

Liu cites four major factors in Shenzhen's success. First is the opening up of Shenzhen as a special economic zone by the central government. "That allowed us to take the lead in developing a market economy, which is a fundamental reason for our success", he says.

The second factor, he believes, was timing. At that time, in the early 1980s, there was an industrial shift in which multinationals were beginning to outsource to centres around the world and Shenzhen offered a good low-cost option.

"Third," says Liu, "citizens, government officials and academics came from all corners of China to Shenzhen. These people were by nature enterprising, innovative and ambitious. Innovation is in their blood," he enthuses.

The fourth factor Liu points to is proximity to Hong Kong. "Hong Kong has a well-developed market economy. It's a world-class financial, trading and logistics centre and we benefit a lot from those attributes."

Liu sees Hong Kong as key to the future development of

Shenzhen. He is the prime instigator on Shenzhen's side of the 'Shenzhen-Hong Kong Innovation Circle', a joint initiative of the two local governments to create a 'united metropolis'.

Four universities in Hong Kong — Hong Kong University of Science and Technology, the University of Hong Kong, City University of Hong Kong, and the Chinese University of Hong Kong — are each putting HK\$50–100 million (US\$6.5–13 million) per year into research centres in Shenzhen.

The relationship between Hong Kong and Shenzhen is very different compared with 20 years ago and the presidents of Hong Kong universities know mainland China well, according to Liu.

Twenty-eight academics of the Chinese Academy of Sciences are in Hong Kong, and Hong Kong universities now have many students from the mainland. These universities will play a "prime role" in the Innovation Circle, explains Liu.

Equally important are the academic institutions in Shenzhen, where Tsinghua University has had a presence for more than 10 years, first as a research institute and now as a graduate school. One hundred and thirty universities have carried out projects in Shenzhen according to Liu.

So, what are the key challenges that lie ahead for Shenzhen? There are many, according to the vice mayor. Foremost is the recruitment of talented people, who, he says, are "worth a fortune" for science and technology development.

"The flow of talented people is without boundaries in this global world," notes Liu. "One of our biggest challenges will be to attract and keep good people."

Liu Yingli — Biography

From farm worker to executive vice mayor of Shenzhen, Liu Yingli's career had an unusual start.

Born in 1948, Liu was sent to a farm in Jilin Province as an "educated youth" from 1968 to 1970, during the Cultural Revolution. Then, until 1978, he was group leader of the Planning and Management Group of the First Automobile Works in Changchun, Jilin Province. Liu was one of the "lucky class of '77" allowed to re-enter university when China re-started higher education. He studied applied mechanics at Jilin Industry University and stayed to complete a masters degree in computational mechanics of engineering technology.

Then, Liu took the unusual step of accepting a job as an engineer in the Electronics Re-

search Institute of Shenzhen, when the city was little more than a small fishing village. During this time he spent a year in Canada working for a software company, ACDS. In 1992, Liu joined the local Shenzhen government and rapidly rose up the ranks of the Financial Planning Department of the Bureau of Science and Technology to eventually become head of the department. He was then appointed assistant to the general director of the Bureau of Science and Technology of Shenzhen before becoming vice director of the bureau. Since then he has held many appointments, including vice secretary general of the Shenzhen Municipal Office from 1996 to 2002, and director of the Lead Group of the High-Tech Industrial Park of Shenzhen city since August 1997.

From September 2002 to May 2005, Liu was vice mayor of the Shenzhen Municipal Government and a member of the municipal Communist Party committee. From January 2003, he was also the director and secretary of the Communist Party committee of the Lead Group of the High-Tech Industrial Park, chairman of the Research Institute of Tsinghua University in Shenzhen, chairman of the National Engineering Centre for Biotechnology in Shenzhen, and dean of the Chinese Academy of Science and Technology Development. From May 2005, he has been a standing member of the municipal Communist Party committee and executive vice mayor of Shenzhen Municipal Government, while continuing in his many other roles.

A platform for growth: the China Hi-Tech Fair



www.chtf.com/english

The China Hi-Tech Fair was established in 1999 as a platform for international companies, investors, inventors, entrepreneurs and relevant government bodies to meet, exchange ideas, make business deals and establish collaborations.

Organized by the Shenzhen Municipal Government, approved by China's State Council and co-hosted by eight government ministries and agencies, the Chinese Academy of Sciences, Chinese Academy of Engineering and the Shenzhen Government, the fair is held on October 12-17 every year.

Its huge success in just 9 years has attracted the world's attention, putting Shenzhen on the high-technology map.

"The city needed to create its own 'name card' to create a brand name," says Wang Xuewei, director general of the Shenzhen Bureau of Trade and Industry who supervises the fair.

In this city of immigrants, Wang's 20 years in Shenzhen make him one of the most experienced policymakers. Formerly an engineer at the Institute of Optics, Fine Mechanics and Physics at the Chinese Academy of Sciences, Wang watched during the late 1980s as companies from the US and Europe moved in to manufacture clothing, shoes and toys. He watched during the 1990s as companies from the same developed countries began to produce and assemble basic electronic goods such as televisions and radios. Shenzhen companies were usually the original equipment manufacturer of products that were repackaged and sold by the foreign companies.

But he also watched as companies in Shenzhen and throughout China gained competency in these areas of basic electronics, setting the stage for China's emergence in the high-tech industry. "Now we need a platform to develop these strengths," he says.

The China Hi-Tech Fair is doing the job. "We want to use this event to enhance our production base in these areas," says Wang. "It is a bridge between technology resources and enterprises, and its purpose is to show the world what Shenzhen wants to be."

Companies and regional governments from all over China attend the fair, but Shenzhen has a special place because of its proven manufacturing ability, which promises to give life to bold ideas. It is a natural complement for many of the companies or entrepreneurs at the fair. "People come here with ideas and designs, but no ability to produce," Wang says. "Here we may not have all the ideas, but we know we have the ability to produce."

The fair has grown rapidly as word has spread about the opportunities it presents. Between 1999 and 2006, the number of countries and regions represented grew from 26 to 42. The number of programs more than doubled, from 4,150 to 9,765, as the number of exhibitors increased from 2,856 to 3,278. The number of investors jumped from 955 to 2,690. Twenty-five foreign governments send delegations, compared with five in



Boundless opportunities for anyone with a good idea.



Opening a new chapter in Shenzhen's history.

1999. And the number of visitors has doubled, from 300,000 in 1999 to 612,000 in 2006.

The fair leads China in focusing on topics of vital concern to the country. In 2006, for example, the fair hosted a 'Recycling Economy Exhibition'. The exhibition's 7,500 square metres showcased leading technologies in energy conservation, new energy, ecological and environmental protection, population and health, and green agriculture. This tribute to sustainable development, a topic of crucial importance to China, was capped with a special section devoted to the Bluesky Award for Renewable Energy Technology and Investment. The special event was hosted by the United Nations Industrial Development Organization.

Last year's fair also featured another topic that has been in the headlines as China emerges on the world's high-technology stage — intellectual property rights. The event featured a forum with senior intellectual property experts from companies and law firms, from China and abroad, to discuss the special challenges faced in China.

Wang relates a story about someone who came to the first fair with patents but little else and, during the course of successive fairs, made connections that positioned him as the chief executive officer of a RMB 100 million company. Wang says there have been many such success stories, and the people of Shenzhen have so much energy that he expects to see many more. "People who think they have something great see an opportunity here and so they come," he says.

Filling a gap in the innovation system



Shenzhen Virtual University Park

The Shenzhen Virtual University Park was established in September 1999 at a crucial time in Shenzhen's development.

In 1980, Shenzhen became the first of Deng Xiaoping's 'special economic zones'. The following 10 years marked Shenzhen's emergence as a cheap manufacturer of products outsourced from Western countries. During the 1990s, Shenzhen embarked on a plan to develop its own core technology, to train and attract more technologically advanced human resources, and to generate intellectual property.

Qiu Xuan, the director of the Shenzhen Virtual University Park says, "As the competition between Shenzhen's processing enterprises intensifies, their individual expectation to take the lead in technological innovation and to own core technology creates market demand for high-end technologies. Usually you would look to the universities to take the lead in innovation, but there was not enough university-based research and training here. Because it was such a young city, we had to look outside."

The Virtual University Park is devoted to bringing in high-calibre researchers, teachers, and intellectual property to help the city's development. Forty-eight research institutions have joined the park, including the University of Hong Kong, the Chinese University of Hong Kong, Hong Kong University of Science and Technology, and three other top Hong Kong institutions. Several institutes, among them the prestigious Chinese Academy of Sciences, the Chinese Academy of Engineering, and the Chinese Academy of Social Sciences, also joined. Top Chinese institutions such as Peking University and Tsinghua University signed up, as did four overseas universities, including the Lyon Central Polytechnic University in France, the University of Alberta in Canada, Budapest University of Technology and Economics, and the University of Miskolc in Hungary.

The high-tech enterprises in Shenzhen have now expanded and urgently need to export their products and trade technologies. This forced them to cooperate with foreign universities. Qiu says that the Virtual University Park is looking to recruit high-end talent, industrialize achievements, and develop international exchanges. At the moment, foreign universities are actively being introduced.

The park serves two main functions. The first is to provide higher education, especially targeted at workers in Shenzhen who want to improve their skills or attain a higher degree, and join the city's high-technology boom. Many of these students are sent by their employers for additional training.

Despite its name, the university provides face-to-face courses. Professors from 35 of the member universities travel to the park to give courses, often on weekends or evenings. Administrators carry-out market research with the universities to determine which courses will be needed. If they are well attended, they survive, says Qiu. A logistics course offered by the Shanghai University of Communications is so popular that only one-third of the students can get in each term, says Qiu. The park has trained 70,000 students, and bestowed nearly



Shenzhen Municipal Bureau of Land Resources and Housing Management

Shenzhen Virtual University Park provides higher education to Shenzhen's workers who want to join the city's high-technology boom.

1,000 doctorates and 17,000 masters degrees.

The park's main function, however, is technology transfer and the licensing of technology from its member universities and other research organizations. An area of 160,000 square metres is devoted to incubating enterprises. Another 180,000 square metres of office space for incubators is under construction.

"More than 200 companies have been born from our incubators using technology from member universities," says Qiu. "Of the incubated projects, we have a 90% success rate."

To help businesses grow, the park organizes meetings among local investment companies, government agencies involved in the promotion of industry, and professional associations. The Virtual University Park is also building its own university science park, a project that has been granted National University Park for Science and Technology status by the Ministry of Science and Technology and the Ministry of Education.

Qiu's next goal is to bring some State Key Laboratories to the park. China has about 180 of these prestigious institutions, mainly within the universities and national laboratories. They each support a few hundred graduate students. Qiu says this would help the park carry out its role of filling the gaps in Shenzhen's emergence as a high-technology power. "Shenzhen is short on research, just like it was short on higher level university training," says Qiu. "Our most important work is to build the laboratories that can give local industry support."

Shenzhen Virtual University Park
www.szvup.com

Bridging academic excellence and innovation with entrepreneurship

'One university, one brand' is a guiding principle of Tsinghua University's new graduate school in Shenzhen. It reflects the school's intention to maintain the high standards of academic excellence of its home institution Tsinghua University, far to the north in Beijing. At the same time, the Shenzhen graduate school seeks to create a new culture through interaction with Shenzhen's vibrant economy and industry.

Tsinghua University ranks as one of China's top universities, alongside Peking University, its neighbour in Beijing. It is quite a coup for the Shenzhen local government to have persuaded both of these prestigious institutions to set up graduate schools in Shenzhen's new university town.

"Our graduate school is focused on developing professionals with leadership skills, international vision, and an enterprising and innovative spirit in a multidisciplinary research environment," explains Guan Zhicheng, the school's dean.

Established on a new campus on the outskirts of Shenzhen only 4 years ago, the school has about 2,000 graduate students, with nearly 1,500 of them based full-time in Shenzhen. All students do some course work at the Beijing campus. About 80 full-time faculty and 200 part-time faculty from Beijing are spread across five divisions: information science and technology, engineering, life science, management, and science and liberal arts.

Two-thirds of the full-time faculty are either from Tsinghua University or have connections to Tsinghua.

"We apply exactly the same procedures for hiring faculty for Shenzhen as the main campus and therefore standards are just as high," explains Guan. Similarly, students face the same rigorous standards for entrance to the graduate school and for completion of degrees as at the main campus.

"I was not sure if I wanted to come to Shenzhen but once I got here I really liked it," says Guan. The campus, next to Lake Xili and the mountains, about 30 minutes drive from the centre of Shenzhen, provides a quiet environment for study. The rapidly expanding high-tech industry of Shenzhen is nearby and interactions with industry are actively encouraged.

Tsinghua University, which is particularly strong in engineering



A production line for compact disks, developed initially at the Beijing campus, has been taken forward for further development at the Shenzhen campus.



Graduate School at Shenzhen, Tsinghua University



Graduate School at Shenzhen,
Tsinghua University

The Tsinghua University Graduate School campus, next to Lake Xili and the mountains, provides a quiet environment for study.

but is also branching out into life science and medicine, generates about 800 patent applications a year. The Shenzhen graduate school has already produced 82 in its short life.

The school aims to be a conduit for the transfer of technology from Tsinghua University to industry. As an example, Guan points to technology for a production line for compact disks that was initially developed at the main campus but has been taken forward at Shenzhen with 14 additional patents. This production line has now been lent to a local company for further development. Until now, such production lines have tended to be imported from overseas.

Professors in the Management Division have also taken part in developing an important new road map for an IP strategy for both the local and central government. Others are advising on transport infrastructure and logistics.

The first batches of graduate students have completed their degrees. While the majority have gone elsewhere for employment, a significant proportion of them — particularly law students — have found jobs in Shenzhen.

The Shenzhen local government is clearly pleased with the graduate school and is giving it RMB 90 million in one-off funds to set up new cluster laboratories. Tsinghua is establishing laboratories in three areas: 'clean production' to help local industry reduce pollution and increase efficiency; 'new media technology', including 3D video systems"; and 'new medicines' where the focus will be on basic research. With funding from Guangdong Province the school has also set up a key laboratory for research in chemical biology.



Guan Zhicheng,
Dean of the Graduate School at Shenzhen,
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An interdisciplinary new generation



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Peking University Shenzhen Graduate School

The challenge for the Shenzhen Graduate School of Peking University was living up to the reputation of its prestigious main campus in Beijing while carving out its own identity as a dynamic research institution that will help the development of one of the fastest growing cities in the world. After 5 years of innovative policies and generous support, the school is succeeding on both fronts.

The graduate school keeps close links to its home institution in Beijing. Students must complete the same entrance procedures, and faculty must meet the same rigorous hiring process. Faculty are largely recruited from Peking University or overseas.

The new graduate school has one definite advantage over Beijing. Old academic barriers do not prevent interdisciplinary studies. Environmental scientists and urban development specialists work together easily, while information technology is taking off on the basis of common ground shared by scientists and engineers working on software, systems, and semiconductor chips.

One of the best examples of interdisciplinary studies is the Laboratory of Chemical Genomics. With more than 1,800 lines of transgenic zebrafish and two common-use nuclear magnetic resonance machines, chemists and life scientists work together in the same building. Biologists identify and characterize important molecular interactions, and chemists design molecules needed to study them. Completing the loop, biologists feed the molecules they have created back into cellular systems for testing. The laboratory, with renowned HIV researcher David Ho as the head of its scientific committee, aims to provide targets for treating HIV, HCV and cancer.

Ye Tao, a member of the chemical genomics laboratory who received his PhD at Queen's University in Belfast, says the laboratory not only exemplifies the type of interdisciplinary research possible in Shenzhen, but is also unique in being run by a group of scientists who all trained in the West and work in a manner similar to Western universities.

The involvement of Ye, a professor at Hong Kong Polytechnic University, also symbolizes the growing network of Hong Kong scientists who are bringing their expertise and entrepreneurial spirit to take advantage of the opportunities in Shenzhen. More of this interaction will occur since the two cities are in the process of finalizing a united 'Hong Kong-Shenzhen metropolis' plan.

Yale University's Zhang Hui, who also leads a research group in the chemical genomics laboratory, says that multinational companies are rushing in. "They want to come to China, and they look around and find our lab."

Wu Yundong, a member of the Chinese Academy of Science and also the vice chairman of the scientific committee of the chemical genomics laboratory, emphasized the laboratory's unique operating system. The scientific committee works closely with the laboratory's director, Yang Zhen, to ensure that interdisciplinary research work meets milestone-based targets and the goals for strategic research and development of the laboratory. The director and the principal investigator's



Research at the Peking University Graduate School complements the strengths of Shenzhen's industry (left). The chemical genomics laboratory, where much interdisciplinary research takes place (right).

committee are responsible for all the hiring, resource allocation and appraisal of laboratory members.

The graduate school will also devote itself to supporting the municipality's development. Law, business and social sciences curricula produce new talent for various sectors of government and private industry. In natural science and engineering, the graduate school has chosen to focus on fields such as information technology and life sciences that "match the strengths of Shenzhen industry", says Executive Dean of Peking University Shenzhen Graduate School, Shi Shouxu.

Such research will help the city reach its dream of becoming a high-tech hub, while at the same time ensuring that fundamental science underlying the necessary innovation is considered. "We won't give up basic research but we will focus on research that might produce benefit for Shenzhen," Shi says.

After 5 years, the school now has 1,811 students. Thirty per cent of graduates stay in Shenzhen taking up positions in law or at one of the booming electronics companies like Huawei or ZTE.

With generous funding provided equally by the local government, the central government, and industry, further growth is certain.



Executive Dean of
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Shi Shouxu.

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A free environment and a window of opportunity for science and technology

The Harbin Institute of Technology (HIT) is 3,034 kilometres from its new graduate education and research arm, the HIT Shenzhen Graduate School. But the distance between the famous mother institution in China's northeast and Shenzhen on the southeast coast means little, says Jin Guangjun, the school's executive dean. "HIT is not geographically limited. It is a brand name," he says.

And it is a powerful brand name. Founded in 1920, HIT has developed into one of China's strongest institutions in computer science, semiconductor and laser engineering, materials science, and mechanical engineering including robotics. In 1999 it was selected as one of nine Chinese scientific institutions to receive additional funding from the government so that it could develop its potential to world-class levels.

The new graduate school will benefit from HIT's expertise, experience, and history, but HIT also stands to gain from the fresh ideas that are starting to come from the south, ideas that provide a window to the future. With some 2,000 universities in China all fighting to show their value, HIT has to stay young, fresh, and well connected to industry needs. The Shenzhen campus, in the bustling and expanding economic hub of China's Pearl River Delta, is helping it meet that goal. "We want to keep our top-nine status," says Jin.

Jin says he was attracted to Shenzhen because of the city's spirit of independence: "We have freedom to do what we want, which is something different from the traditional Chinese university." In Jin's own field of urban design, the expanding city allows him to let his imagination unfold and take advantage of multidisciplinary expertise at the school. Over the past three decades Shenzhen has been transformed from a fishing village to a massively crowded and complex city. "The basic architecture is done. Now we have to make it a more comfortable place," says Jin, who has been working on the 'New City Center' project in the Bao'an district.

While maintaining strong ties to its home institution, the Shenzhen Graduate School will have a great degree of independence. The school can open up new interdisciplinary fields of endeavour, which will in turn give it the freedom to work flexibly with international collaborators and with industry.

Indeed, promoting industrial collaboration is a driving force behind the graduate school. Already there are five laboratories from which HIT staff collaborate with local Shenzhen companies. Local industry funds some 65 other projects with RMB 16.4 million.

It is rapidly becoming one of China's most international schools, with 50% of courses taught in English. To achieve this, the school has taken advantage of increasingly strong ties with neighbouring Hong Kong. More than 30 professors from Hong Kong universities have adjunct positions at the graduate school. Some are paid, while others come to take advantage of the research funding available in Shenzhen. "Many more Hong Kong-based professors are interested in coming," says Jin. The



Harbin Institute of Technology Shenzhen Graduate School



HIT staff from the graduate school's five laboratories collaborate with local Shenzhen companies.

broad range of English curricula will help the school appeal to prospective foreign staff and students. "We want to broaden the international horizon. We would love to see even more foreigners here," he says.

The number of articles published by graduate school staff in key scientific and engineering journals, as indexed by the Institute of Scientific Information, jumped about tenfold between 2002 and 2006. Since its first group of graduate students signed up in June 2002, the school now has some 1,500 masters students and more than 300 doctoral students from all over China. So far, graduates have had a 100% employment rate, with 70% being hired by Shenzhen's booming companies. The very practical training given at the school has been key to this success, which benefits HIT, the graduate school, the students, and Shenzhen.



Executive Dean of
HIT Shenzhen Graduate School,
Jin Guangjun.

Human resources fuel economic transformation



Shenzhen University

In early 1983, Deng Xiaoping, the reforming head of the Chinese Communist Party, was driving down the road near Shenzhen's Back Bay when he passed a huge construction site. He was told it was the site for Shenzhen University and although construction had only started in spring, students would start enrolling the following fall. Deng nodded with a smile and said, "Shenzhen speed."

The university has become an engine for the spectacular growth of Shenzhen where, on Deng's suggestion, a special economic zone had been established a few years earlier.

"The history of the university is the history of the city," says Zhang Bigong, the university's president. Indeed, many of the buildings that have come to symbolize Shenzhen's soaring economic growth were designed in the university's school of architecture.

Unlike most universities in China that are supported by the central government, Shenzhen University is funded by the city government. This gives it a greater degree of flexibility, which its leaders have used to establish a pioneering institution.

Shenzhen University's first two goals were to provide human resources and technology for the special economic zone; and to contribute to internationalization of the city by providing a forum where Chinese and foreign researchers could exchange ideas.

Finally, the university itself would be an experiment in higher education. It has fulfilled this goal with policies such as putting its faculty on short-term contracts rather than hiring them as permanent staff, charging students a fee to cover part of their tuition costs, and giving a committee of professors the final say in important matters instead of the university president.

Such pioneering efforts have made Shenzhen University a "hot" institution in just over 20 years, says Zhang.

Although it was a new university, Deng's support enabled Shenzhen to recruit high-quality faculty, mostly from Peking or Tsinghua universities. The 1,800 faculty include many notable researchers, such as Li Jingzhen, who has pushed the frontiers of extremely high-speed photography; and Ruan Shuangchen who has made lasers with practical applications in spectroscopy, fiber optics, medicine, and display. Niu Zenqiang of the university's Optoelectronics Institute created a YAG laser that has been commercialized by Shenzhen United Winners



Shenzhen University campus.

Shenzhen University

Laser System. Sales of the lasers, in Japan and elsewhere, have already topped RMB 9 million. Liu Zhigang has capitalized on research into common allergens to produce an allergen diagnosis protein chip, which has been commercialized by Shenzhen Synogene Digital Co., Ltd.

Many of the university's 27,000 graduates have also become key players in Shenzhen's economic development. Li Yi, a graduate in electronic precision machinery, has become the chair of the board of Shenzhen TRONY Science and Development Co., Ltd. Shi Yuzhu, who completed a masters degree in soft science management at Shenzhen University in 1989, went on to start a software company (Giant Corporation) and was, for a time, China's eighth richest man.

The university's most famous success story is Ma Huateng. After graduating with a bachelors degree in computer science in 1993, Ma went on to co-found Shenzhen Tencent Computer System in 1998.

The university's contribution to Shenzhen has earned it ongoing support, including RMB 90 million for scientific research in 2006 from government and local industry, nearly a 50% jump over the previous year. The university is now finalizing plans for a medical school, funded with RMB 3 billion.

Internationally, the university's presence is being felt, with 600 international students from 40 countries and 30 of its faculty from overseas. Zhang has a vision of making Shenzhen University one of China's top 20 universities over the next decade. The success achieved already and continuing support makes him confident it can be done.



University President,
Zhang Bigong.

Shenzhen University

Shenzhen University
Nanhai Avenue 3688, Shenzhen 518060, P.R. China
www.szu.edu.cn/en



Shenzhen University has high hopes that its work in photonics will open up new industry in Shenzhen.

Chinese culture and Western expertise prove a successful mix



Huawei Technologies

Manufacture of telecoms equipment and provision of next-generation solutions for fixed, mobile and data communications are core business for Huawei Technologies.

More than one billion users and 31 of the world's top 50 telecommunications operators — including British Telecom, Vodafone and Telefonica — use Huawei's products. From a small trading agent to a global telecommunications giant, the story of Huawei, the most-respected enterprise of Shenzhen, reveals how the market-orientated high-tech companies in Shenzhen were driven by customer demand, and how they developed and grew through innovation in management and technology.

"Understanding and communicating with our customers is an important factor for our success," says Xu Zhijun, Huawei's chief marketing officer.

"Since 1996 we have consulted with companies, including IBM and Hay Group, to develop a management style based on Western expertise which includes Chinese culture. Our management process enables us to speak the same business language as our customers."

Huawei also continues to innovate based on customer requirements and, unlike many other vendors, continued to invest in R&D during the 'IT bubble'. In fact, 48% of staff are involved in R&D, which gives the company a leading edge in terms of both technology and solutions. The 3G base station is one such solution.

"Conventional 3G base stations are 'cabinets' which require a lot of space which the operator must rent," says Xu. "The initial cost is only about US\$10,000–20,000 but the operating costs are high because the operator has to rent the space and pay for the large power supply."

"We provide distributed NodeBs, which use less space and power with the result that running costs are cut by 30%. European companies, including Vodafone and Orange, are big users of this distributed NodeB solution," he says.



Staff dormitory and swimming pool; Huawei offers competitive packages to attract talented staff.

Huawei offers very competitive packages to attract talented staff. "It was difficult in the early days but our brand is very well known now and it is easier to find good people. Now for every one hundred CVs we accept only one," says Xu. Huawei senior managers are aged in their 30s and typically manage businesses of US\$1–2 billion.

Huawei Technologies was founded in 1988 and is wholly owned by its 70,000 employees. The company started in Shenzhen from a small base and has grown with the support of Shenzhen's pro-business policies.

Challenges for the company have included the transition from domestic to international markets. In 1998, when Xu managed the company's international business, the perception of Chinese products was shoes, toys and low-quality products.

"When I talked with customers they did not believe that a Chinese company could produce high-tech equipment."

Huawei made a resolute decision to go global.

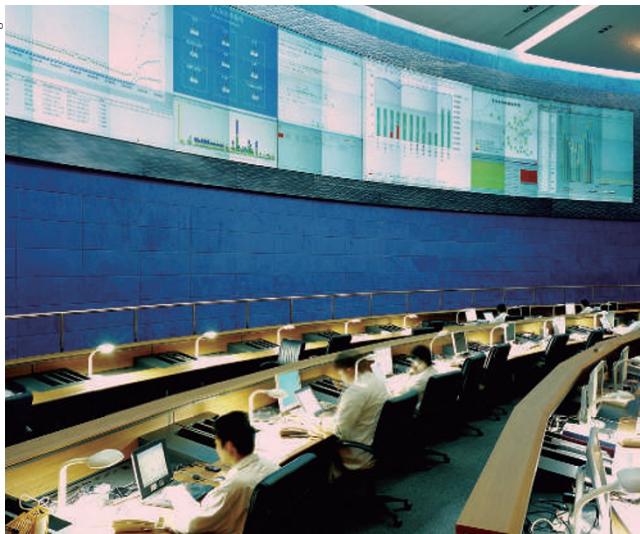
"We were determined to expand to overseas markets, which is how we are here today," explains Xu. Now, over 65% of sales are overseas and in 2006 the company generated net revenues of US\$8.5 billion and US\$11 billion in contracts.

But, going global required an internationally recognized management process, which the company found through consulting with many Western companies. Future expansion is planned to take advantage of China's low R&D costs.

"Our business model of high-quality, excellent service, low operating costs and giving priority to customer requests cannot be copied by Western companies," says Xu.

Intellectual property is high on the list of priorities for Huawei, which has submitted more than 19,000 patent applications to date. "Our company is only 19 years old and we are willing to discuss cross-licensing. We are prepared to buy patents. That is our strategy," he says.

How far can Huawei go in the future? Xu is confident, "We want to become the Toyota of telecoms! We are now aiming for this target."



Huawei Technologies data centre.

Huawei Technologies
Bantian, Longgang District, Shenzhen 518129, P.R. China
www.huawei.com

Global success from local wisdom

ZTE 中兴

Zhongxing Telecommunication Equipment (ZTE) Corporation

ZTE Corporation is the world's fastest growing manufacturer of telecommunications equipment and wireless solutions. The company, which was founded 22 years ago by Hou Weigui, is China's only telecoms company with shares traded publicly on both the Hong Kong and Shenzhen stock exchanges.

An ongoing investment in R&D has enabled ZTE to provide customized technologies and services to companies in more than 120 countries. It is the only Chinese telecoms manufacturer to be listed in *BusinessWeek's* 2005 Top 100 Information Technology Companies, as well as *BusinessWeek's* 2006 Top 20 Brands.

But how did a small start-up evolve into a US\$4 billion company providing 3G technology after only 21 years?

"Our success is firstly tied to China's open-door policy launched in the early '80s, which stimulated a huge demand for telecommunications-related equipment," says senior vice president, Xie Daxiong.

"Shenzhen's designation as a special economic zone enabled us to grow initially with production of digital switches, then fixed transmission and mobile communications."

ZTE now has more than 100 products, embracing wireless, wireline, service and terminal technologies.

"Shenzhen has always been very helpful to us," says Xie.

"Our initial market was rural China, then we concentrated on the cities and finally we went global. Now, 52% of our sales are from overseas business." In the first half of 2007, ZTE's total international business revenue was RMB 7.97 billion. This figure has increased by 99% in comparison with the same period in 2006.

Forty per cent of the company's 40,000 employees are involved in R&D, across 15 wholly owned R&D centres in North America, Europe and Asia. The R&D staff are hired locally and given well-defined objectives.

"We recruit the best people to achieve our goals," says Xie. "From the early days of launching the company, we have invested about 10–12% of our annual revenue on R&D."

ZTE also provides customers with training at nine dedicated facilities worldwide, including the ZTE University, which has trained more than 130,000 people in China and overseas.

At the end of July 2007, the company had submitted more than 9,300 patents. Attaining intellectual property rights has been a core element of its strategy since inception.



ZTE handsets of the future.

"We produce our own IPR portfolio which enables us to interact with much larger companies through cross-licensing agreements," explains Xie.

Examples of ZTE's patented innovations include the world's first CDMA mobile telephone with a detachable SIM card, which was launched in 2000 and the world's first global open trunking architecture system (GoTa) CDMA-based digital technology announced in 2004. These technologies were the first to be licensed to overseas vendors by a Chinese telecoms manufacturer.

"The future is in wireless communications; both systems and handsets," says Xie. "Chip design is one of our core technologies which we will use for development of new products and solutions."

Success is based on motivated and innovative staff, and ZTE recruits from China's top universities. Employees have an average age of 30, about 70% are university graduates and, of these, 25% have a masters degree and 1.4% have a PhD. ZTE has been voted 'Most Favorable Enterprise for Employment' for four consecutive years by 60 universities in China.

The company has a global presence, with collaborators that include Vodafone, Alcatel, Ericsson and France Telecom in Europe. It maintains three R&D centres in the US; has customers in South America including Brasil Telecom and VIVO; enabled the first 3G call made in Africa; and has customers in Saudi Arabia, Pakistan, Tajikistan, Mongolia and Vietnam. This global success epitomizes ZTE's motto of 'Global success from local wisdom'.



ZTE Senior Vice President,
Xie Daxiong.

ZTE Corporation
ZTE Plaza, Keji Road South, High-Tech Industrial Park,
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wwwen.zte.com.cn



ZTE headquarters and R&D building in Shenzhen.

Building dreams for the future



BYD Company Ltd.

The world's largest manufacturer of rechargeable batteries has successfully turned its hand to other IT components and automobiles. BYD Company Ltd., established by Wang Chuan-fu and 30 like-minded people in 1995, now employs more than 100,000 people and is listed on the Hong Kong stock exchange. This is a success story of Shenzhen's high-tech enterprises winning wealth through the integration of labour and technology, and ultimately walking the path of high-end research and development.

With the goal 'Build Your Dreams', president Wang says the founders took advantage of China's unique business factors — namely, the availability of low-cost, talented people and an enormous market.

"The huge demand for IT products and automobiles in China brought many overseas companies here," says Wang. "With them, they brought their supply chain and hence a route for our products. Our business model could not possibly be used in countries like the USA or Japan."

In the early years the company focused on the manufacture of rechargeable batteries. Intense investment in innovative R&D enabled BYD to produce high-quality, low-cost products that attracted customers including Motorola and Nokia.

The revenue generated from batteries and other IT components gives BYD the scope to enter other business sectors.

"We found that the battery and IT components market was difficult to expand," says Wang. "We decided to enter the automobile business because we thought it had a brighter future." In 2003 BYD bought the Tsinchuan Automobile Company, and created the BYD Auto Company Ltd.

"The battery and auto businesses are both labor intensive so we thought we could translate our experience [in] manufacturing high-quality batteries at competitive rates to the auto industry," explains Wang.

R&D is central for both businesses and BYD acquired non-patented technology to improve the quality of its products. The company has seven industrial bases across China, covering a network of R&D, production and logistics. The factory in Xi'an can produce 200,000 cars per year. The BYD F8 is the first car in China with a retractable glass hard-top roof.

Another important decision was locating the company's headquarters in Shenzhen. "In 1995 Shenzhen's special economic zone was very open to doing business. The municipal

government had many useful regulations for establishing businesses here. It was an age of the market economy and Shenzhen took the lead," says Wang.

The company places a high priority on recruitment, with production workers and R&D staff recruited from across China. R&D on materials, software and vehicle engineering is carried out at the BYD Central Research Institute and the Telecom and Electronics Research Institute, where activities include WiFi, acoustics and auto electronics.

Technicians and production staff are trained at BYD's technical school, which covers an area of 60,000 square metres within the BYD industrial park in Longgang. BYD provides free dormitories and sports facilities for its employees. They even have their own village with a kindergarten, club, restaurant and supermarket. The company fully sponsors its own BYD middle school, which is authorized by the Shenzhen Municipal Government.

Maintenance of intellectual property rights (IPR) is important for such a young company. "With 80–90% of our products for export, we must maintain a high-quality IPR portfolio. In 2006, the company was granted 1,166 patent applications." Altogether, BYD has 2,500 patent applications, including those granted and pending. More than 1,000 cases are filed in China and at least 50 cases in other countries each year.

BYD was chosen as one of the 'Stars of Asia' by *BusinessWeek* magazine in 2003 owing to the success of its Li-ion battery.

"The Li-ion business was dominated by Japanese industry but our products gave the market an alternative manufacturer," notes Wang.

The high quality and low cost of BYD's batteries have been key factors in their international acceptance.

Plans for the future are based on BYD's core technologies of IT components and automobile manufacture. The company is already using its batteries to produce electric cars.

"The F3e is our first battery-powered vehicle. BYD stands for 'Build Your Dreams' and we are confident that we can succeed with electric vehicles," says Wang.

BYD Company Ltd.

Yan'an Road, Kuichong, Longgang, Shenzhen 518119, P.R. China
www.byd.com



The BYD F3e integrates BYD's IT and auto businesses.



BYD's journey began with its high-quality, low-cost rechargeable batteries. BYD's headquarters in Shenzhen.



BYD's president, Wang Chuan-fu, accepts *BusinessWeek* 'Star of Asia' award from former US president, Bill Clinton (right).

Multi-dimensional platform connects people across China

Tencent 腾讯

Tencent Holdings Ltd.

Tencent is China's leading internet company, connecting more than 600 million registered instant messaging (IM) user accounts and over 30 million peak simultaneous online user accounts. The company was launched in 1998 by Ma Huateng (CEO) and Zhang Zhidong (CTO), both computer engineering graduates from Shenzhen University. Tencent is a success story of Shenzhen local university students and how they combined IT and lifestyle into not only a new business model, but also the 'Shenzhen dream'.

"In 1998 the founders wanted to start a Chinese paging network, which we eventually called QQ, for connecting people in real time via a platform that used the internet," says the president, Martin Lau, who has a masters degree in electrical engineering from Stanford University and an MBA from the Kellogg Graduate School of Management, Northwestern University.

Tencent's QQ instant messaging platform was extremely successful, making a profit of US\$53.9 million in 2004. In June 2004, the company went public on the Hong Kong stock exchange where the initial offering raised HK\$1,787.8 million.

The QQ platform has grown tremendously because it provides a multi-dimensional way for people to stay connected. "QQ is not just text but a very rich means of staying connected either visually, using PC-to-PC instant messaging, as personalized animated characters called avatars, or by interactive games such as chess and cards," says Lau.

But how has Tencent succeeded in China where giants like Google and Yahoo struggled? The answer lies in China's unique internet landscape where more than half the internet users are under 30 and interested in using it for chatting and entertainment, rather than searching for information.

"QQ is successful because in China there is a huge demand for the internet as a means of socializing. Also, China is a huge country and people on the move want to stay connected so they use QQ," explains Lau.

A browse through Tencent's website also shows the variety of ways that people can connect. "We have content that enables a rich way of connecting. It's not just text messages as in e-mail. People can connect by playing games or sharing photo albums and music," says Lau.

Locating the company in Shenzhen was an important component of its success. "The availability of talented staff was extremely important," explains Lau. "Shenzhen attracts talented people from all over China because of its vibrant environment and entrepreneurial spirit."

"We could say that the city itself is a 'start-up' and its government entrepreneurial. The city government is proactive in a number of ways, such as giving tax advantages, the use of telecommunications infrastructure and organizing conventions to attract investors," he says.

Commenting on Tencent's recent award of 'Best Chinese Lifestyle Brand', Lau notes it shows that QQ has become a part



People can connect to Tencent's QQ by playing games or sharing photo albums and music.

of people's lives.

And for the future? "We are focusing on communications and community; entertainment, such as online games and videos; content in the form of music portals and video channels; and e-commerce — which is a new business area for us," says Lau.

"The internet has an enabling power. It is still in its infancy and many more innovations and business opportunities are yet to come."

Lau says that for Tencent to evolve, the key factors will be to attract motivated people, stay entrepreneurial and build around the company's core technologies and ideas.

It seems as though Tencent's mission to create an 'online society' in China has only just begun.



Tencent president, Martin Lau, says Shenzhen attracts talented people from all over China.

Tencent Holdings Ltd.

Tencent Holdings Ltd.

Fiyta building, Gaoxinnyanyi Avenue, Southern District of Hi-Tech Park, Shenzhen 518057, P.R. China
www.tencent.com/index_e.shtml

Shenzhen base for world's first gene therapy



SiBiono GeneTech Co., Ltd.

Gendicine, a recombinant adenoviral-p53 agent primarily for head and neck cancer, was the world's first gene therapy product to be approved for commercial production when it was given the go ahead by China's State Food and Drug Administration (SFDA) in January 2004. That it was developed in Shenzhen reflects the Shenzhen economic zone's high-technology research and development strategy.

Gendicine was the brainchild of Peng Zhaohui, chairman of Shenzhen SiBiono GeneTech Co., Ltd. Gendicine received new drug certificate approval from the SFDA in October 2003, a manufacturing licence in January 2004 and has been on the market in China since April 2004.

A biochemist by training, Peng was previously a professor and director of the Institute of Molecular Biology at China's Nanfang Medical University. He has studied at Chiba University in Japan and at the University of California at Los Angeles and worked for a biotech company in the US, before returning to China in 1998.

After returning to China to establish SiBiono, Peng initially considered moving to Beijing or Shanghai, before finally opting to locate in Shenzhen because the Shenzhen government supported the project as part of its policy of attracting innovative high-tech companies.

"Another advantage of Shenzhen is the presence of a number of excellent universities," says Peng.

"Given the need for specialized staff in such a venture, as well as graduates from Shenzhen and elsewhere in China, SiBiono recruits specialists from overseas," he adds.

About 10% of SiBiono's staff are Chinese who have returned from overseas. The company provides competitive salaries and challenging career opportunities to help minimize staff turnover.

As of July 2007, Gendicine had been administered to more than 6,000 patients, about 400 of whom were Caucasian. Most treatments were for solid tumours such as head and neck squamous cell carcinoma (HNSCC), hepatocellular carcinoma (HCC), nasopharyngeal carcinoma (NPC), and other cancers

that are relatively common among Chinese populations.

"Gendicine has been used off-label for more than 50 different types of cancer, but the only approved indications are for NPC and HNSCC," explains Peng.

While Gendicine monotherapy is effective, it has significant synergistic effects in combination with chemotherapy, radiotherapy, surgery, or thermotherapy. For example, in a phase II/III clinical trial in HNSCC patients, 64% were in complete regression after 8 weekly injections of Gendicine combined with radiotherapy, which is 3 times greater than with radiotherapy alone. Five-year follow-up results demonstrated that Gendicine improved radiotherapeutic tumour control by 11 times versus radiotherapy alone in NPC patients, with the 5-year overall survival and tumour-free survival rates being 13.5% and 28% higher than the radiotherapy control group, respectively. In late-stage HCC, Gendicine with chemotherapy was associated with a short-term efficacy of 67%, which was 16% higher than chemotherapy alone, while the 1-year survival rate increased 19.4% with the combination.

Gendicine is safe, with no evidence of the extreme immune responses reported with adenoviral gene therapies elsewhere. "In about half of the patients there was a low-grade fever about 3 hours after the injection, which lasted 2 to 6 hours then spontaneously regressed," says Peng.

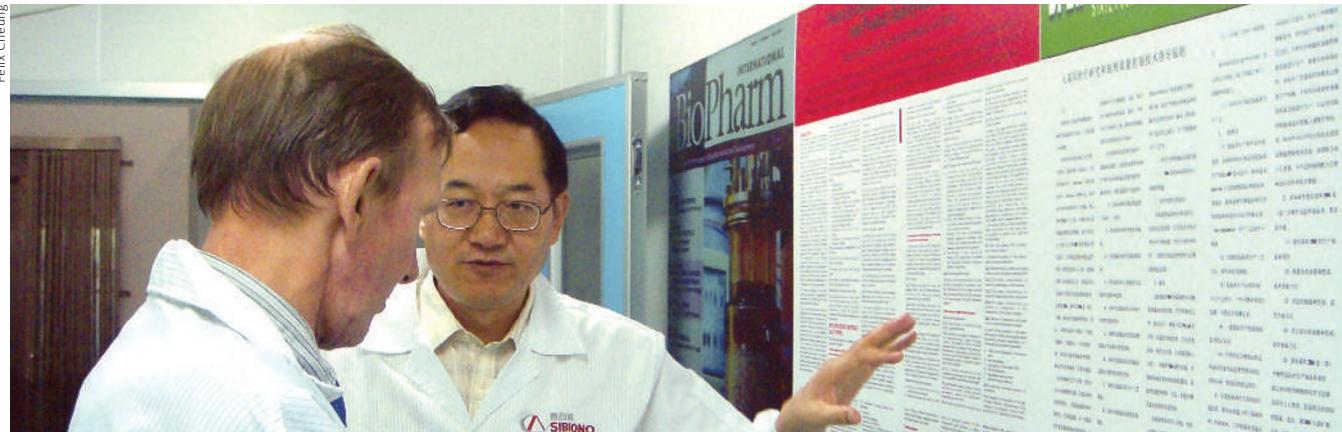
"At present, SiBiono's manufacturing capacity is about 150,000 Gendicine doses per year, which is likely to increase next year after the company moves to its new RMB 200-million production facility, still in Shenzhen. Gendicine is manufactured according to current Good Manufacturing Practice, a system for ensuring that medicines are consistently produced and controlled according to quality standards.

Shenzhen SiBiono GeneTech Co., Ltd.

Shenzhen Hi-Tech Industrial Park (North), Langshan Road,
Shenzhen 518057, P.R. China

www.sibiono.com

Felix Cheung



Chairman of Shenzhen SiBiono GeneTech Co., Ltd., Peng Zhaohui, was attracted to Shenzhen by government support for innovative high-tech industry.

Pioneer in mobile memory storage is Shenzhen success story



Netac Technology Co., Ltd.

Netac Technology Co., Ltd. illustrates the success of Chinese students who established their business in Shenzhen and ventured into the world via the China Hi-Tech Fair platform. Since its establishment in the Shenzhen economic zone in 1999 as a pioneer of USB flash drive memory storage systems, Netac has emerged as an R&D leader in mobile memory storage and digital entertainment products worldwide.

In 1999, while Frank Deng was still a student in Singapore, he heard that Shenzhen was organizing the first China High-Tech Fair. He immediately rushed to the city with his rough sample of the now ubiquitous 'flash drive' and an invention patent.

Deng attended the fair with almost no expectations. But, courtesy of the fair, he had access to a free exhibition booth, food and accommodation. And when an investor from Singapore heard of his invention, he contacted Deng immediately and decided to invest in developing the technology. Shenzhen government later provided RMB 12 million as venture capital funds so that he could file the patent for his invention.

"Shenzhen has excellent government services. Both the local and central governments encourage innovative technology companies, as China moves towards high-technology production and innovation," explains Netac's president and CEO Deng.

Netac's major activity in Shenzhen concerns R&D, which is carried out at the company's state-of-the-art facility in the Incubator Building of the Chinese Academy of Science and Technology Development. However, R&D can be prohibitively expensive, especially for a technology start-up company.

"The Shenzhen government has set up an IT design platform, which we use at a low cost," says Deng. "Such platforms are normally very expensive and the Shenzhen government allows all of the local IT design companies to rent the platform very cheaply."

"The science and technology department of the Shenzhen government has also been very helpful and supportive towards us and very quick in responding to any R&D or IT problems," he explains. Shenzhen seems to be better in this regard than other major cities of China, according to Deng.

Another advantage of Shenzhen is the abundance of qualified staff. "It is not difficult for us to recruit talented people," says Deng. While some of Netac's staff training is done in-house the company also sponsors some of their R&D and IT design engineers to do graduate studies at universities in Hong Kong.

"Of course, many of our engineers have also studied here in Shenzhen, where many of China's leading universities, including Tsinghua, Peking and Harbin, have branches. The Shenzhen government has attracted leading mainland universities to establish graduate schools in Shenzhen. This is a local government policy and a lot of our staff have studied there."

Netac offers expertise and services to develop products according to clients' needs. The company has a small manufacturing facility in Shenzhen and provides original design manufacture and original equipment manufacture to customers such



Netac

Netac is among the world's leading suppliers of mobile memory storage and digital entertainment products.

as Dell, IBM, Samsung and Toshiba. In fact, 80–90% of products are made on an 'original equipment manufacturer' basis.

"We also sell our own brands to them," says Deng, adding that 70% of his company's output is for domestic consumption, with the rest being middle- to high-end items for export to markets worldwide.

Netac is among the world's leading suppliers of digital entertainment products, with a major focus on MP3 players for in-car audio systems.

"We are focusing particularly on USB hard drives. This is a very big market, not only for PCs, but also for use in TV," adds Deng.

Netac's only competition comes from manufacturers in the US and Taiwan. "We are absolutely number one in mainland China, where no-one can compete with us," says Deng, noting that Netac has filed more than 300 patents covering USB flash drive technology worldwide, including the US, Korea, Singapore, Hong Kong, China, Europe and Japan.



Felix Cheung

Netac President and CEO,
Frank Deng.

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6F, Incubator Building,
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www.netac.com

From biochips to drug discovery



Shenzhen Chipscreen Biosciences Ltd.

A biotech/pharmaceutical company specializing in drug discovery and development is unusual in China, where most pharmaceutical companies make generics. Shenzhen Chipscreen Biosciences Ltd., using its own integrated chemical genomics discovery platform, is one of the few companies operating in this area.

Chipscreen was founded in 2001 as a Sino-US joint venture by the company's director, president and chief scientific officer, Lu Xianping, and other returnees from the US.

"The first thing you notice about Shenzhen after living in the US is that it is very beautiful, is much cleaner and has better weather than other Chinese cities," says Lu.

"More importantly, several years ago Shenzhen began undergoing dynamic commercial development and we liked the strong market economy, which is really pushing us forward," he says.

In some ways Shenzhen reminds Lu of his former base in California. "I spent 10 years in San Diego, which, like Shenzhen, has an immigrant culture and is very vibrant and innovative."

The Shenzhen government was very supportive in terms of issuing permits and other paperwork needed to start the company and import the high-tech equipment they needed. Chipscreen also received about \$US2.5 million in government research grants.

"If we had tried to do this elsewhere in China, I'm not sure it would have worked," says Lu. Chipscreen is partnered with Tsinghua University, one of the company's largest shareholders and owners of the building housing its headquarters.

The company has more than 50 employees, 27% of them with PhDs. Investors come from Singapore, Hong Kong and from other Chinese cities.

"Most people working here have been here for several years, so we do not have problems retaining staff," says Lu, who plans to hire more people as the company continues to grow.

"Most of our PhDs are trained in the US, which is important," he says, noting that in the past, the Chinese generics-based industry had not been highly skilled in terms of innovation and discovery, although this is changing with the new generation of Chinese PhDs. At Chipscreen, "we are innovators, not imitators".

Chipscreen minimizes drug development time and costs by using its proprietary state-of-the-art chemical genomics technology to match potential small molecules to disease targets. Reference compounds are then used to screen for potential pharmacological activity and toxicities, which enables informed decisions to be made at an earlier stage in drug discovery development. In this way "we can decrease attrition rates and increase success rates", explains Lu.

The company has completed phase IIa clinical trials of its anti-diabetes drug chiglitazar on more than 240 diabetes patients and is about to enter Phase IIb. Regarding safety, "so far so good", he says, with no sign of the cardiovascular toxicity that has caused other agents in the same class to be withdrawn late in development. Upon successful completion of life-long toxicity studies in rodents, chiglitazar will be submitted for Phase III trials. If everything goes as planned, chiglitazar may



Felix Cheung

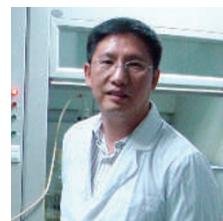
Chipscreen is partnered with Tsinghua University, one of the company's largest shareholders and owners of the building housing its headquarters.

be ready for product launch by 2010, according to Lu.

Chipscreen also has a new anticancer drug, chidamide, which is looking safe and effective in an ongoing Phase I trial.

"It is going extremely well, so last year we out-licensed the rights to chidamide, excluding use in China, to a US biotech company."

Developments in the pipeline include some exciting new molecules, including a series of enzyme inhibitors with potential in oncology and in areas other than cancer. After further development, the most promising will be contracted out to Chinese clinical research organizations for drug trials. Another product in development is an interesting compound derived from traditional Chinese medicine that appears to protect the liver and has received market authorization approval.



Chipscreen Director,
President and Chief Scientific Officer,
Lu Xianping.

Felix Cheung

Shenzhen Chipscreen Biosciences Ltd.

Suite C301, Research Institute of Tsinghua University,
High-Tech Park, Nanshan District, Shenzhen 518057, P.R. China
www.chipscreen.com

Global reach from Shenzhen



China International Marine Containers (Group) Ltd.

With more than 1,000 products in 10 categories, China International Marine Containers Ltd. (CIMC) is the world's largest manufacturer of shipping containers.

Most of the products are used in marine and railway transportation, including containers, vehicles and tank equipment. The rapid growth of CIMC is a stellar example of how high-tech enterprises in Shenzhen are relying on technological innovation to add value to their traditional products.

CIMC's growth mirrors that of its home city, Shenzhen, which over the past 25 years has grown from a cheap mass-production centre for Hong Kong factory owners to become the booming modern heart of China's high-technology sector.

When the company was first established in Shenzhen in 1980, the same year the city was designated a special economic zone, it was one of China's first Sino-foreign joint ventures. At that time, CIMC had an annual production of just 10,000 dry freight containers and was competing with about 20 similar companies in China. After listing on the Shenzhen Stock Exchange in 1994, CIMC expanded rapidly, building facilities at major ports along the China coast that gave it a competitive advantage over its rivals. CIMC has been the global leader in terms of volume since 1996.

CIMC chose Shenzhen as a base for commercial reasons. The city's status as China's first special economic zone was important for imports and exports.

"As a logistics company, we have to span the globe, and Shenzhen was the most convenient city in this regard," says Liu Chun-feng, the general manager of the R&D management division.

"When Shenzhen was first designated a special economic zone we had special tax breaks on exports, and exemptions for imports of raw material," Liu explains.

However, with China joining the World Trade Organization, he says that, in future, they will need to rely on the strength of their industry to compete.

"After more than 20 years of development, Shenzhen has



Zhang Luding, CIMC

CIMC manufactures more than 1,000 products used in global transportation.

come up to the standards of other international cities, so we are quite strong, especially compared with other cities in China."

In the area of staff recruitment, Liu says that, among talented people in China, the flow is now relatively free. "If the conditions you offer are very good, then you will attract the best talent in China, for example graduates from Peking, Shanghai Xiatong and Tsinghua universities." CIMC also hires internationally for specialized skills.

"For example, in the area of quality assurance, standards must be up to international levels and the talent in this field is from Europe or the USA," says Liu.

While most of CIMC's products, such as tanks and vehicles, are traditional, the company has been developing a Smart and Security Container (SSC), which uses a computer system and radio-frequency identification to track containers as they move around the world.

"A smart chip, including WiFi technology, can track the container throughout the whole transportation process," explains Liu.

"This will tell you the container's contents and whether it has been tampered with illegally. The initial aim of the SSC was for anti-terrorism; however, we realized that it also needed to be profitable, so we linked it to the commercial and logistics side."

As well as marine containers, CIMC has an airport equipment division that manufactures automatic air cargo and logistics handling systems, automatic parking systems, and passenger boarding bridges. These are used at more than 70 airports worldwide and include the boarding bridge for the new Airbus A380, the world's largest aircraft. "We are the first choice for most global transport businesses," concludes Liu.



CIMC has developed a system to track containers as they are transported around the world.

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