



**CENTER FOR RESEARCH
ON INFORMATION
TECHNOLOGY AND
ORGANIZATIONS**

University of
California, Irvine
3200 Berkeley Place
Irvine, CA, 92697-4650

CHINA IT REPORT

Author:

Jason Dedrick and Kenneth Kraemer¹

Center for Research on Information Technology and Organizations

University of California, Irvine

email: kkraemer@uci.edu , jdedrick@uci.edu

October 2001

¹ Kenneth L. Kraemer is professor of management and computer science in the Graduate School of Management and Department of Information and Computer Science, and Director of the Center for Research on Information Technology and Organizations (CRITO) at the University of California, Irvine. Jason Dedrick is a Senior Research Fellow at CRITO. This research has been supported by a grant from the U.S. National Science Foundation (CISE/ISS/CSS).

China IT Report

Jason Dedrick and Kenneth L. Kraemer

Center for Research on Information Technology and Organizations

October 2001

This report is based on a research visit to Beijing from September 8-16, 2001. The trip unfortunately was darkened by news of the terrorist attacks on the U.S. that week. We found the Chinese people we met after the event to be very sympathetic, with nearly all offering condolences and condemning the attacks. For news, CNN, Fox, and CNBC were available at our hotel, and CNN ran a feed directly from the U.S. rather than the CNN International that is the usual fare outside the U.S. Local Chinese stations likewise had extensive coverage. Web sites such as the New York Times were available online, with no apparent blocking of access.

China's economic growth has remained rapid in the face of the Asian financial crisis and the current global economic slowdown, supported by domestic demand and inflows of foreign investment. However, China is not immune to economic events elsewhere, especially given its reliance on exports in some of its most dynamic industry sectors, such as information technology (IT). If the events of September 11 lead to recession in the U.S. and elsewhere, China will certainly feel the effects. China needs to make major structural changes to prepare for admission to the World Trade Organization, and an economic slowdown would make some of those changes more difficult and painful.

Internet

China has seen rapid spread of the Internet, with an estimated 26.5 million Chinese now online, up from 8.9 million in 1999. Of these users, 32% had purchased something online in the past year, although less than 1% said that shopping online was their primary reason for using the Internet. The most common purchases were books, computers, consumer electronics and appliances.¹ Internet use, like information technology (IT) use in general, is heaviest in the Beijing, Shanghai and Guangdong areas, which have benefited most from China's economic growth of the past two decades.

The profile of Internet users is changing in China from the young, single, college-educated men who were early adopters (as in most countries). In CNNIC's July 2001 survey, 38% of Internet users were female, 48% were over 40 years old, 36% had a high school degree or less, and 41% were married. These figures are all substantially higher than even a year earlier, showing how much the Internet is spreading to a broader cross-section of Chinese society.

¹ Data from China Internet Network Information Center (CNNIC) 2001 survey of Internet use.
<http://www.cnnic.net.cn/develst/rep200107-e.shtml>

China has nine interconnected Internet backbone networks: China Telecom, China Mobile, China Golden Bridge Network (ChinaGBN), Uninet, China Netcom, CIETNet, which handles much of China's electronic commerce traffic, China Great Wall Network (CGWNet), CSTNet, and CERNET, an educational network. These networks are said to have good transmission speeds internally, but the interconnection speeds among networks is much slower. These networks are the only ones authorized to connect to the global Internet, and only through approved gateways.²

Most Chinese Internet users log on from work and to a lesser extent from home, but many use Internet cafes or libraries, which offer low cost access for many who do not have PCs. A nationwide crackdown that began in April led to the closing of more than 8,000 Internet cafes, for promoting crime and corruption by giving access to pornography.³ Certain subjects are off limits, and access to certain sites are blocked. Particular concerns are pornography, online games, and anti-government information.

Electronic commerce

Starting in 1999, there was a flurry of e-commerce activity, with dot.coms such as sohu.com, sina.com, China.com and Netease going public on the Nasdaq exchange, and investment rushing into the Internet sector. However, the Nasdaq crash of 2000-2001 caught China as e-commerce was just getting off the ground, and since then there has been a cooling of activity. The dot.coms are just trying to survive, and many established companies have been spooked into rethinking their e-commerce plans. As one interviewee put it, the traditional companies, especially state-owned enterprises, feel that if the "experts" at the dot.coms couldn't make a go of e-commerce, then their own prospects were probably poor.

Not all companies feel this way of course. There are some Chinese companies that are pointed to as successfully using the Internet as a tool to coordinate with their suppliers or customers. One example is Legend Computer, China's number one PC vendor. Another is Haier, a major consumer electronics and appliance maker, which handles orders from its own marketing units electronically. A third is Shanghai Baoshan Iron and Steel Co. At the industry level, the banking and financial services sector is considered to be a leading IT user, with the highest levels of computer usage, networked computers, and overall informatization. The telecommunications industry is a close second. On the other hand, banks have been relatively slow to go online, with only 19% having operating Internet sites, according to an eWeek survey. By contrast, 75% of chemical companies, 56% of telecoms companies, and 51% of manufacturers have operating web sites. Somewhat surprisingly, the education sector leads by a wide margin in having e-commerce applications under development.

² William Foster and Seymour E. Goodman, 2000. *The Diffusion of the Internet in China*. Center for International Security and Cooperation, Stanford University.

³ Elaine Kurtenbach, "China tightens grip on booming Internet cafes," Associated Press Newswires, 7/22/2001.

Among the major state-owned enterprises (SOEs), there are a few leaders in e-commerce as well, including China Petrochemical, China Electronics, Chinese Chemical Import/Export, and China Food and Oil Import/Export. These are mostly firms involved in international trade, who adopt e-commerce to interact with foreign customers and to respond to foreign competition. Most SOEs have not adopted e-commerce, and those that have are mostly at the pilot project stage. The government has created a new Supervisory Committee of China State-Owned Core Enterprises, which oversees the management of the 100 largest SOEs. This body is encouraging these SOEs to adopt IT and e-commerce as tools to cut costs and improve productivity.

According to IDC estimates, e-commerce revenues totaled US\$2.2 billion in 2000. Of this, B2B accounted for US\$1.68 billion and B2C US\$522 million. IDC forecasts e-commerce sales of US\$5.6 billion in 2001. Most market analysts forecast very rapid growth in e-commerce over the next few years, especially in the area of mobile e-commerce, given the high penetration of mobile phones. However, there are significant barriers to e-commerce in China that could make such forecasts look optimistic.

Barriers to e-commerce

There is considerable interest on the part of government and companies in developing e-commerce in China, but there are some formidable barriers to adoption. For consumers, the biggest barriers are the limited diffusion of PCs, high cost of Internet access, and lack of easy payment mechanisms.

- PC diffusion in China is only about 3 per 100 people. However, China's PC market continues to grow at 25-30% per year, and low-cost PCs bring more consumers into the market. Also, China has 120 million mobile phone users who could potentially access the Internet via mobile connections.
- The high cost of Internet access, and the low bandwidth available to most users, is a serious problem. Basic Internet access costs about \$30 per month, a significant share of the average worker's income, and customers are charged by the minute for local access. High costs and slow downloads make browsing and shopping expensive.
- The lack of payment mechanisms prevents transactions from being completed online. There is no national credit card processing capability, and few Chinese have credit cards anyway. More have bank debit cards, but are reluctant to use them online. Those that purchase online often pay by bank draft or cash-on-delivery.

In addition to these visible barriers, there are other factors that affect consumers' willingness to purchase online. One is the presence of a dense network of retail stores in residential areas, making e-commerce less of a convenience than it might be in the U.S. Also, there is a lack of trust in online vendors, as customers are used to dealing with merchants face-to-face, and are not sure if online orders will actually be filled, or how returns or other problems will be resolved.

Businesses are affected by some of the same issues as consumers, such as Internet access and telecommunications costs, and inability to process transactions online. Other

challenges include a sketchy delivery network, lack of commercial banking facilities, and uncertainty about tax regulations on e-commerce.

- Inadequate transportation and delivery network. China lacks nationwide delivery companies such as FedEx and UPS, and transportation infrastructure (road, rail, air) is poor in many areas.
- Banking services. Commercial banking services are very limited, with only four state-owned banks and 10 shareholding banks offering commercial services.
- Taxation. As of now, e-commerce transactions are not taxed, but the government is debating how to handle taxation in the future. This uncertainty may discourage firms from investing in e-commerce capabilities.

In addition to these common problems that face all businesses, most enterprises have to deal with equally serious internal shortcomings. First is the lack of the necessary information systems and infrastructure to support e-commerce. Most firms do not have enterprise applications linking sales, production, finance, service and other functions, and many lack even more basic applications in each of those areas. Without such systems, it is difficult to conduct transactions electronically, and what is called e-commerce is actually limited to e-mail and an informational web site.

Equally problematic is the need to make significant organizational changes in order to take advantage of the opportunities provided by IT and e-commerce. China is still in the transition from a planned to a market economy, and many firms are just beginning to think about issues such as product quality, customer service, and profitability. Reorganizing operations and implementing IT to focus on these goals will require a difficult and often painful transition for most firms. Large firms may have greater resources, but also have the most ossified management structures, while more flexible smaller firms may be hampered by limited financial and human resources.

Government policy

In order to create a more conducive environment for the adoption of IT and e-commerce, the government has launched a series of policy initiatives. The government's efforts to promote IT go back to the 863 Plan introduced in 1986, a technology development scheme that included promotion of IT production and use. Most significant were the series of "Golden" projects, including the Golden Bridge national data network (now one of China's Internet backbone networks) and other projects aimed at developing IT infrastructure and applications.

IT moved further to the forefront in the tenth Five-Year Plan, 2001-2005. The plan states that, "Information technology should be used extensively in all circles of society and the use of computers and the Internet should be widespread." In addition, the plan calls for the development of electronic commerce and the use of information technology in commercial sectors such as banking and finance, and in government departments such as taxation and trade.

The tenth Five-Year Plan earmarks 1.7 trillion yuan (about US\$200 billion) for spending on information and communications technologies. Of this, about 1.2 trillion yuan (US\$150 billion) will go into telecommunications, and another 400 billion yuan (US\$50 billion) for electronics manufacturing.

To coordinate its efforts to improve telecommunications and promote IT, the government is setting up a new high-level informatization commission directly under the State Council. This commission, headed by Premier Zhu Rongji, will supervise the telecommunications and broadcast industries and promote e-commerce and informatization. It will have authority over relevant ministries, including the Ministry of Information Industries, which will remain the administrative body in charge of regulating telecommunications and the Internet.

In the area of Internet and e-commerce, government policy has been guided by the sometimes conflicting goals of: (1) promoting use as a tool for economic development and government coordination; (2) maintaining control over the flow of information, including criticism of the government; and (3) limiting foreign participation in telecommunications, Internet services and information content.

Some steps have been taken to promote e-commerce. For instance, a group of 13 banks under the People's Bank of China has created the China Financial Certification Authority (CFCA), to enable secure online transactions for more than 100,000 corporate banking customers and stock traders. Also, it is now possible to transmit legally-binding contracts electronically within China, but not externally. For e-commerce to take root, a number of other legal and policy issues must be resolved:

- Rules must be created to allow international contracts to be transmitted electronically and be legally binding.
- Digital signature legislation must be passed.
- Encryption technologies must be made available to enable secure transactions.
- Regulations on foreign participation in Internet services and content should be eased.
- Taxation rules for online transactions need to be clarified.

As part of the five-year plan, initiatives have been announced to develop electronic certification and payment systems, a credit system, and to promote adoption of e-commerce in traditional industries.⁴

China's government also continues its efforts to develop a strong domestic technology base. One way is through investment in R&D, which has grown rapidly. Another is by requiring foreign firms to transfer technology to China in return for market access. Given the size and potential of the China market, many foreign firms are willing to make this tradeoff, even with conditions they would not grant in other countries. There may be a risk of creating new competitors, as happened in the past in Japan, but foreign companies appear confident that they

⁴ Stephen Anderson and Shujuan Cao, 2001. "Beijing's April events for e-commerce and information technology," International Market Insight, U.S. Commercial Service.

are not transferring their latest or most strategic technologies. They see more of a win-win situation, as has been the case in Taiwan.⁵ Time will tell if their confidence is well placed.

Computer market

China's personal computer market, once dominated by foreign firms such as IBM, Compaq and Hewlett-Packard, is now firmly in the grip of domestic firms, most notably Legend, which controls over 32% of the fast-growing market. Legend's success in China has made it the number one PC vendor in the Asia-Pacific (non-Japan) market, according to IDC. After Legend, the next largest market shares belong to Founder, IBM, Great Wall, and HP. Dell, which only entered the market in 1998, reached sixth place in 2000 with 3.5% of the market, and has reached 4.5% in 2001. So far, Dell has mostly sold to multinational corporations in China, but is now targeting the education and small business sectors. Compaq, which was number one in 1995, stopped manufacturing in China in 1998 and has now dropped out of the top ten. There is no word on HP's plans for the China PC market if its proposed acquisition of Compaq goes through.

Table 1. PC market share in China, 2000

Company	% share
Legend	32.7
Founder	10.4
IBM	6.0
Great Wall	5.2
Hewlett-Packard	4.2

Source: IDC

The PC industry has followed the pattern of other technology markets in China, with foreign firms enjoying solid profit margins until domestic firms become competitive, at which time foreign firms abandon the low end of the market and try to move up the ladder to higher value products. For now, foreign firms are stronger in servers, although China Langchao is the market leader and Legend has targeted the server market.

Legend's market dominance is attributed to several factors. One is its ability to develop an extensive dealer network in its early days as a reseller for HP, Toshiba and AST. When Legend began selling its own brand PCs in the early 1990s, it utilized that network to distribute its products throughout the country. It has continued to extend its reach to cover everything from large cities to small provincial towns, giving it an advantage over all of its competitors. The relationship with HP was also beneficial as Legend adapted many managerial practices from the HP model.

Legend has become the low-cost PC producer in China, taking advantage of local production costs and low overhead levels to undercut foreign PC makers. In a very price sensitive consumer market, this cost advantage, combined with Legend's distribution

⁵ For details, see Jason Dedrick and Kenneth L. Kraemer, 1998, *Asia's Computer Challenge: Threat or Opportunity for the United States and the World?* Oxford University Press. Chinese version (2001) from Times Publishing.

reach and strong customer service capabilities, are an impossible combination for foreign firms to match.

Legend has come to capture a large share of the government and education market, where institutions are expected to buy local products whenever possible. It also benefits from favorable access to low-cost capital and other political support as a sort of national champion. Interestingly, it did not start out this way, as Great Wall Computer was clearly the government favorite, having been spun out from the Ministry of Electronics Industry in 1986. But Great Wall, which is said to operate as more of a typical state-owned enterprise, has failed to match Legend's aggressiveness, flexibility, and profit-oriented management.

The continued success of Legend will depend partly on its ability to extend its leadership into the server market and into wireless telephony, and partly on its success in new markets such as information and Internet services. Legend operates an Internet content business called FM365, and has a relationship with China Telecom to bundle one year of China Telecom's Internet service with Legend PCs. It also recently announced a new relationship with AOL/Time Warner, although the nature of the joint venture's offerings have not been defined.

Finally, while Legend now produces motherboards and other components for foreign customers on an OEM basis, it does not yet export its own PCs. While it has stated that it will not export in the foreseeable future, it certainly bears watching as a potential power in the Asia-Pacific region.

The other company making major gains is Founder, a firm affiliated with Beijing University, which has nearly tripled its market share since 1997. Founder has used an aggressive sales and pricing strategy to jump into second place with over 10% of the market. So-called "white box" or non-branded clones, which until recently accounted for over half of the market, have lost share rapidly and now only account for about 25% of the market. These companies have lost their price advantage as branded vendors such as Legend have cut prices, and they cannot offer the service and reputation of brand name companies.

Software

For many years, the most visible issue in China's software market has been the high rates of illegal software in use. This situation has not changed much, according to the Business Software Alliance, which reports a 94% piracy rate in China for 2000. On the other hand, one executive at a U.S. subsidiary questioned those figures, pointing out that the big PC vendors such as Legend and Founder pre-load legal software on their PCs, and that central government agencies all use legal software in their offices. Still, there is undoubtedly a considerable amount of piracy in spite of government and industry efforts to enforce intellectual property laws.

Now, however, new developments are taking place that may reduce the level of piracy and also lead to the growth of a more dynamic software industry in China. As part of the Ten-Year Plan, China has specifically identified software as a strategic sector for development. Chinese policy makers have visited India and studied its success in software and hope to emulate that experience. Some projects involve promotion of Linux applications, development of secure e-commerce software, production of enterprise applications, and development of educational software.

With Linux, China hopes to reduce its dependence on Microsoft operating systems. This goal is treated as a matter of national security and economic independence, but has also undoubtedly been encouraged by Microsoft's own missteps in China. These include Microsoft's introduction of Windows software that had been developed in Taiwan, and a statement by Bill Gates that he hoped to get Chinese customers addicted to Microsoft software and then figure out how to charge them for it later. But while the government is encouraging Linux use and development, most customers use Windows, and most developers make Windows applications, as the Microsoft product is considered easier to use and has good development tools.

The effort to develop a domestic software industry will only succeed if piracy rates can be reduced, as local firms cannot afford to develop products and have them copied illegally. A more serious crackdown on piracy would be equally beneficial to foreign software firms. Better protection of intellectual property rights would also encourage more foreign firms to outsource software development to China.

IT services

The IT services market is underdeveloped in China. According to one executive, two years ago, no one knew what IT services were, but now people see it as a sector with good potential. However, unlike the U.S. or Europe, where companies such as IBM Global Services, EDS, Accenture and Cap Gemini offer a wide range of services from consulting and system integration to complete outsourcing, China has a very limited range of services and providers. There are several reasons for this.

First, foreign companies such as IBM are not allowed to offer many of the services they provide in other markets, due to government restrictions on their activities. For instance, IBM can provide support and service for its own hardware, but generally cannot support other hardware that its customers may have. It also cannot provide outsourcing services. Compaq did have a joint venture with local vendor Founder to provide services, but the venture had limited success and was eventually folded.

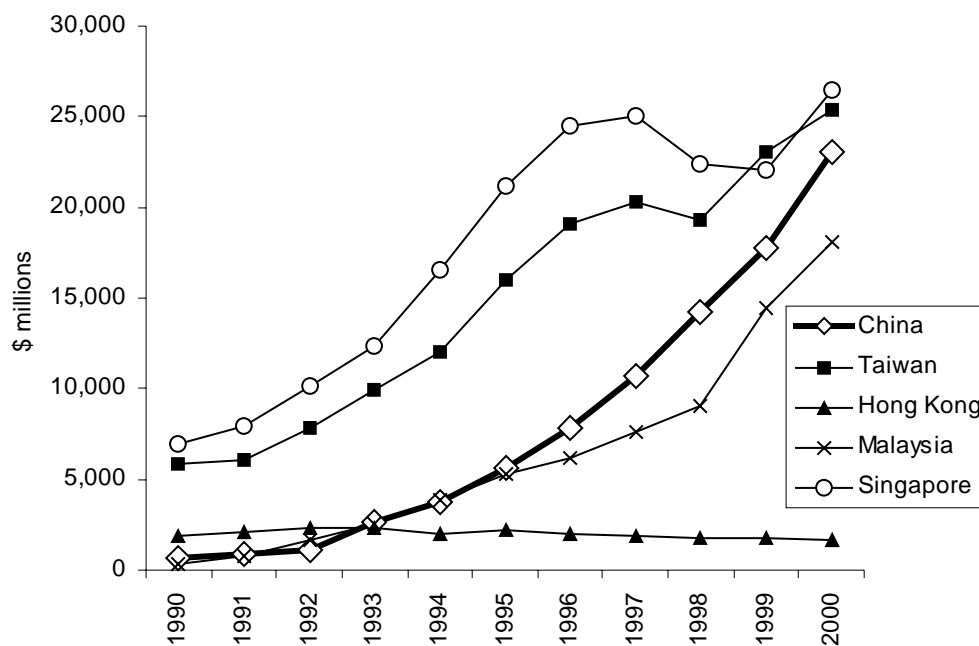
Second, it is a common maxim that Chinese companies do not like to pay for services. This is partly for lack of trust in outsiders handling critical corporate information. It also is because the cost is considered high, and organizations find it cheaper to hire relatively low-cost engineers and IT professionals and have them handle system integration, customization, and maintenance.

Third, services in general have been neglected in China, as economic reforms concentrated on agriculture and manufacturing. Only now, with WTO accession looming, is China beginning to focus on services. The greater awareness of services is also a simple realization of the economic potential of these sectors.

Computer production

China has become a major player in the global PC production network, and is expected to surpass Singapore and Taiwan to become the third largest producer of computer hardware in 2001 (following only the U.S. and Japan). This from a country that had virtually no computer production a decade ago.

Figure 1. Hardware production 1990-2000, China, Taiwan, Hong Kong, Malaysia, Singapore



Source: Reed Electronics Research, *Yearbook of World Electronics Data, 2001*

The rapid growth in production is partly driven by growth in domestic demand. Domestic vendors naturally produce in China, and they have come to control two-thirds of the PC market. Because of high tariffs on imported PCs and peripherals, foreign vendors gain a significant cost advantage by producing locally, so firms such as IBM, Dell, HP and Acer have production facilities in China.

In addition, China has become a major export platform for many components and peripherals, such as motherboards, keyboards, add-on cards, scanners and printers. Many of these are produced by Taiwanese companies. As the Taiwan government eases restrictions on production of high-value items in China, it is expected that much of Taiwan's notebook PC production will shift there as well. Already, major notebook

producers such as Quanta, FIC and Inventec have established plants to make notebook subassemblies, and are ready to move to complete assembly. Given the small scale of China's notebook market (only 6% of PC sales), most of this production will be for export, at least initially.

Production capacity is growing rapidly as PC makers build new plants or expand existing ones. Legend is opening a new facility in Shanghai that will have a capacity of 1.5 million PCs annually, and Founder has opened a plant in Dongguan with capacity of 1.6 million units. IBM opened a new plant last year in Futian dedicated to export production. Dell has been expanding production and employment rapidly in Xiamen, and has now announced plans to begin producing PCs for export there. There are some concerns that China is creating excess capacity for PC production, as is already the case with color TV production. With the global slowdown in PC demand, there is little room to increase exports, and domestic capacity may soon outstrip demand.

Most of China's hardware production is located in the southern coastal regions, particularly in Guangdong province, close to transportation facilities and plentiful supplies of components. The Shanghai area is becoming another major center, especially for Taiwanese companies who are congregating in the Kunshan area. Other foreign firms are located in the Suzhou Industrial Park, originally developed by the Singapore government but since taken over by the local government. Beijing's Haidian district is the site of Zhongguancun high-tech development zone, located in close proximity to Beijing University and Tsinghua University. Legend's largest existing plant is in northern Beijing, but it is adding new capacity in Shanghai rather than Beijing in order to provide geographic coverage and tap lower cost labor.

Conclusions

China is making rapid strides as a producer of computer hardware, and is taking steps to expand and upgrade its use of IT throughout the economy. Given its huge market potential and low-cost labor, it has been able to negotiate with foreign firms for technology transfer and attract large amounts foreign investment. There are many barriers that must be surmounted if China is to tap the potential of the Internet and e-commerce, including high telecommunications costs, lack of needed legal guidelines, and some aspects of consumer behavior and business practices. The next several years will be critical, as China joins the WTO, liberalizes more sectors of its economy, and continues to reorganize state-owned enterprises and the financial system. These processes will largely determine the nature of China's IT sector and how IT is used throughout its economy.

For more detail on the dramatic growth of China's PC industry during the last decade, and the role of foreign and Taiwanese companies, see Kenneth L. Kraemer and Jason Dedrick, "Creating a computer industry giant: China's industrial policies and outcomes in the 1990s" at <http://www.crito.uci.edu/git/>.