FROM NATIONALISM TO PRAGMATISM:
IT POLICY IN CHINA

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**ABSTRACT:** Since 1978 China has been transforming its centrally-planned socialist economy into a more mixed market system. China has also largely abandoned its nationalist technology strategy aimed at achieving self-reliance in favor of a more pragmatic strategy of importing advanced technologies and directing domestic R&D toward commercial purposes. This change has been evident in China's policies toward information technology (IT). The government has given up its goal of producing all classes of computers and is now focusing on increasing IT use and promoting production of personal computers, peripherals and software. In addition, China is planning massive investments to expand and modernize its telecommunications network. These policies have resulted in rapid growth in IT use and production, but China still faces serious challenges in trying to develop a coordinated strategy for IT production, use and infrastructure. These include bureaucratic infighting, problems with privatization of IT enterprises and concerns about loosening control over the flow of information. The rapidly expanding Chinese market offers tremendous opportunities for foreign companies, but they are finding China to be a difficult place to do business.

**KEYWORDS:** China; electronics industry; telecommunications infrastructure; business environment; technology policy; computer policy; hardware market; software market; hardware production; software production.

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Since 1978 China has been transformed from a centrally-planned socialist economy to a mixed market system. The government has introduced market incentives, given more authority to enterprises and opened the economy to foreign investment, unleashing rapid economic growth and creating a new export juggernaut in the Pacific Rim. At the same time, China has largely abandoned its nationalistic technology strategy aimed at achieving self-reliance in favor of a more pragmatic strategy of importing advanced technologies and directing domestic R&D toward commercial purposes.

The change in technology strategy is seen clearly in China's policies toward information technology (IT). During the 1970s and early 1980s, China tried to develop a full line of computer hardware and software, incorporating as much indigenous technology as possible. After 1986, the government began to emphasize IT use throughout the economy, development of production capability by joint ventures with foreign multinationals, and production of low-end IT products for export.

The results of the more pragmatic approach to IT policy have been a rapid increase in the use of IT, a rapidly growing computer industry, and expanding exports. IT use is still low compared to other countries, but investment in hardware, software and services has increased about 20% annually since 1989, and shows no signs of slowing. Production of computer hardware grew 29% annually from 1987 to 1993. Given its market potential, its large pool of engineers and computer professionals, and its low cost labor force, China is likely to become a major producer of low-end computer hardware and Chinese language software in the next ten years.
The strategy also worked well in expanding exports. China's exports of high-tech products in 1992 came to US$4 billion, 38.8 percent higher than the figure for 1991. Computers and communications equipment led the way, earning US$1.9 billion in foreign exchange. However, China remained dependent on imported technology and components, and continues to have a trade deficit in high-tech products. Total high-tech imports came to US$10.7 billion, with computers and communications equipment constituting 35.7 percent of the total.\(^1\)

While China's official strategy is shifting from a nationalistic pursuit of self reliance to a more pragmatic mix of technology imports and export of lower-end products, actual policy changes have often been taken *ad hoc*. There is not yet a clearly defined vision of the future of IT in China. Nor is there an institution in government with the authority and capability to develop and implement a comprehensive national IT plan, as authority is divided between agencies variously concerned with issues such as telecommunications, computers, information services, education and R&D. In part, this is due to Chinese political culture which resists allowing power to rest in a single institution or agency, but it is also a deliberate strategy to allow market forces to shape IT development rather than rely entirely on central planning.

**IT INFRASTRUCTURE**

The production and use of information technologies typically requires a supporting infrastructure including human resources, dependable telecommunications networks, research and development capabilities, and complementary industries such as consumer electronics and electronic components.

**Human Resources**

China's population as a whole is not especially well educated compared to developed or newly industrializing countries, and does not have high levels of scientists, engineers or programmers *as a percent of its population*. But China's population is so large that the *absolute number* of those professionals is very high. For instance, as of 1990, China had about 1,170,000 programmers, well behind the U.S. (2,006,000), but ahead of India (917,000) and Japan (977,000) (Table 1). So IT producers and users have access to a large pool of skilled
professionals who work for much lower wages than their counterparts in more developed countries. These professionals may not be as productive as their counterparts in the U.S. or Japan, but that is mainly due to lack of tools, which can be bought, and experience, which can be developed over time.

[Insert Table 1 here]

**Telecommunications Networks**

Basic telephone service is currently provided to about 2% of China's 1.2 billion population, although urban areas have a penetration rate closer to 20%. There were over 600,000 cellular telephone subscribers at the end of 1993, and subscribership is projected to hit 2 million with service in 400 cities by the end of 1995. The Ministry of Posts and Telecommunications (MPT), which is responsible for the telecommunications infrastructure, is unable to keep up with the overwhelming demand for basic phone services, not to mention the demand for new services (data, messaging, mobile) from government, business and academia. For example, there were only 200,000 fax machines, six electronic mail systems each having 3,000 mailboxes with a capacity of 100,000 bytes, one voice mail system having 50,000 mailboxes, and no on-line data services in China in 1992.2

MPT wants to triple the 32 million telephone lines in the country to about 93 million by the year 2000, achieving a 7% overall and 40% urban penetration (Figure 1). This means that MPT wants to do in 15 years what took 40 years in Japan and 80 years in the U.S. MPT's strategy is to build a single, unified network to provide basic telephone services under its monopoly, while allowing competition for non-basic services. The rationale is that a unified network is needed and that only a monopoly provider can raise sufficient revenues to provide universal service.3

[Insert Figure 1 here]

MPT said in 1994 it would invest $41.4 billion, including $7 billion in foreign capital, over the next six years in its massive program to triple the number of switched lines.4 This is equivalent to creating one Baby Bell a year for seven years, and would still leave China with a
telephone penetration level of just 7% for the whole population (Figure 1). However, there are serious questions as to whether China's goals are realistic. The sheer magnitude of the physical task involved in laying cable and installing switches is enormous; the financing for such large investments continues to elude China's planners; and coordination between the central government and the provinces, which control the local providers and access to local loops, is likely to prevent China from expanding its communications network as fast as planned.

While China's telecommunications infrastructure as a whole is seriously deficient, some areas such as South China have good access to advanced telecommunications services. Two high-capacity fiber gateways from Hong Kong to China are in operation, linking Hong Kong, Shenzhen, Dongguan, Huizhou, and Guangzhou. A web of international private leased circuits (IPLCs) based in Hong Kong support over 70 international companies operating in southern China's industrial development zones. The rapidly growing coastal regions will probably develop advanced telecommunications services before most of the country has any service at all.

Research and Development

China's R&D spending was 0.72% of its GNP in 1991. This compares to 2.77% for Japan, 1.91% for Korea, 1.70% for Taiwan and 0.91% for India. About half of China's R&D is financed by government agencies and half by enterprises (including state enterprises). In the past, R&D was concentrated on defense technologies or on basic research, with little effort made to develop commercial technologies. This trend is starting to change as the economy becomes more market-oriented and government science and technology policies focus more on the needs of industry.

Complementary Industries

China has a large electronics industry, with production of US$17.6 billion in 1993 (Figure 2), but the industry is technologically backward and consists mostly of consumer electronics (TVs, VCRs) with little industrial electronics production (semiconductors, components). China's domestic electronics industry suffered a serious competitive blow with the decentralization of the electronics industry in the early-1980s. The result was that each province
set up its own factories to produce components. The number of factories increased from 2,688 in 1982 to 3,299 in 1992, with an average employment of 500 workers. Thus, there are numerous factories; they often produce the same products; and few are achieving the economies of scale necessary to move down the learning curve and bring manufacturing costs down and quality up. The industry is also plagued by aging equipment, low labor productivity and shortages of parts and components. As a result, more foreign components have been imported in recent years (estimated at 40-50% of total need). Most producers still do not operate on a fully commercial basis, meaning that there are no clear performance measures based on profits and losses, and government subsidies shelter inefficient producers.

China's semiconductor production is expected to increase from $2.4 billion in 1994, or three percent of the world market, to $4.3 billion in 1997. China's domestic enterprises are expected to produce only $390 million worth of chips, leaving the rest to foreign manufacturers. Various big players have set up shop in China. Advanced Micro Devices Inc. is teaching Chinese engineers how to incorporate AMD chips into products, Motorola Inc. has set up a plant in Tianjin to assemble pagers and cellular phones, and Intel is shipping semi-finished 386 chips to China for final assembly. The Chinese government plans to invest $300 million in chip equipment in 1994, and Chinese chip makers have been visiting Silicon Valley, hoping to find good buys on used equipment. China's semiconductor production will consist mostly of simple assembly and testing operations until it is able to develop the technical capabilities to handle more advanced processes such as wafer fabrication.

In summary, China's IT infrastructure is poor but improving. Its greatest asset is the large number of computer programmers, which provide low cost, skilled professionals for both IT producers and users. Its big plans to expand telephone services between and within the large urban centers may turn out to be somewhat unrealistic, but will still result in a leap forward in telecommunications. China's R&D is becoming more applied and commercially oriented though the level of spending is still low. The weakest element in China's IT infrastructure is probably
the electronics industry, which normally is complementary to the computer industry, providing components and skilled workers for the industry. However, China's electronics enterprises are technologically backward and unable to meet the demand of their own markets, let alone transfer many resources to the IT industry.

**TECHNOLOGY POLICY**

China has targeted science and technology research institutes as keys to economic competitiveness. In the past, research institutes developed products that often had no relation to market needs. To encourage researchers to respond to the needs of industry, the government has cut the budgets of state-sponsored research institutes, forcing them to turn to industry for funding. The government also has implemented a number of technology programs in recent years. One plan, started in March 1986 and therefore called the 863 National High Technology Development Program, targets eight strategic technologies for development, including IT, biotechnology, energy, materials, automation, lasers, space and telecommunications. Another, the "Torch Plan," was launched in 1988 to accelerate the development and commercialization of new technologies, including computers. The government also is pressing foreign companies in China to make commitments to local sourcing, training and technology transfer.

**Information Technology Policy**

From 1981-1985 the government's objective was to build a domestic computer industry and avoid technological dependency on the West. It sought foreign investment and technology with which to develop its own mass-production facilities. Foreign vendors were not interested in such investments, but some, such as IBM, were successful in exporting computers to China.

By 1986, the government began to encourage joint-ventures where foreign vendors would bring technology and manufacturing skills and local companies would provide inexpensive labor and access to the domestic market. The government still sought to build a broad-ranging computer industry from mainframes to PCs to components, but had little success in developing higher-end products. By 1991, China abandoned its goal of self-reliance, decided to import high-end computers such as mainframes and minicomputers, and oriented its strategy for the domestic
computer industry around microcomputers, workstations, software and peripherals. By exporting these products, MEI hopes to earn foreign exchange to import expensive higher-end systems and the technology needed to sustain and upgrade its domestic IT production.

China's electronics industry, including computers, was given priority status by the government in March 1993. This status provides the industry with preferential treatment, increased government investment and exemption from periodic austerity measures to the year 2000. Primary responsibility for the computer industry was given to the MEI, and specifically to its Computer Department. MEI also has a Telecommunications Department which is concerned with setting policy to link the government's many private data networks.

China's strategy for the computer sector, which is mostly being developed and implemented by MEI, consists of five elements:

1. *Promote computer use throughout the economy.*

Although MEI's objective is to promote the computer industry in particular, the industry's development is seen more broadly as a means of expediting national economic development. China's leaders (e.g., Premier Li Peng and Vice-Premier Li Lanquing of the State Council) view the diffusion of information technology as an accelerator for economic development and modernization of all industry sectors. As part of China's ten and five-year plans, greater resources are targeted for promoting the industry and promoting the application of IT throughout the economy.

The government has also lowered trade barriers to encourage IT diffusion. Import duties were reduced from 82% in 1992 to 35% in 1993, and are expected to be reduced to 15% in the future. There are several reasons for the change. First, industry protection through import duties results in higher prices for computers and therefore conflicts with the broader goal of promoting IT use. Second, the current policy is being systematically undermined by outright smuggling and by "double screwdriver operations". Duties and taxes are more than 35% for a completely assembled computer. However, the tax on components is only 17%. As a result, some companies in Hong Kong buy completely assembled computers from abroad, take them apart,
and bring them into China at the 17% rate. They then reassemble them in China, thus avoiding the higher tariff rate. These computers, plus those smuggled in, are estimated to be around 50% of the official number of PCs installed annually. The third reason for change is that China expects to become a member of the GATT(General Agreement on Tariffs and Trade)/World Trade Organization in the near future and will be required to reduce its import duties to around 15%.

These changes will put China's domestic computer companies under severe competition. The computer industry wants protection for a longer period of time, but MEI feels that it cannot impede application of the technology to other industries just to support the computer industry. MEI has stated that after 1995, government subsidies to domestic computer companies will be discontinued and they will have to compete on their own merits or go out of business. It is unlikely that this will actually occur because there are many jobs involved and China has not shown yet that it is ready to accept the downside of the market system, i.e., bankruptcies and unemployment. However, some consolidation and reorganization of the industry is possible.

2. *Separate the management of enterprises from the government functions of policymaking and regulation.*

MEI's Computer Department has been reorganized, separating its regulatory and production functions. It is supposed to serve mainly as a policy/regulatory body for the industry instead of sending down detailed plans and production quotas to the state-run enterprises under its control. However, it is unclear how this new enterprise management will work out. The Ministry still prepares socialist type production quotas and five year plans for the enterprises. In addition, many of its senior staff are both high ranking officials in the ministry and members of company boards or senior managers. MEI owns 216 computer factories, 36 of which are PC facilities. Approximately five of these state-owned enterprises produced 82% of China's total domestic computer output in 1992. The others produce components, peripherals or small quantities of PCs.

3. *Encourage alliances with foreign vendors.*
China lacks the production capacity to meet its own needs for computers, and also lacks the technology to produce advanced products. So MEI encourages joint ventures in which foreign companies are given access to the local market in exchange for transferring technology to their Chinese partner. It is promoting joint ventures more frequently than in the past, and on more favorable terms to the foreign partner. MEI is also requiring technology transfer from foreign companies as the price of admission into the fast growing Chinese IT market. That market, in addition to China's pool of computer professionals and abundance of cheap unskilled labor, is a powerful attraction to companies which control needed technologies. In addition to technology transfer, China is requiring multinationals to export around half of their production to try to improve China's trade balance in IT.

4. **Promote Technology Parks**

Foreign production, start-up enterprises, and technology transfer are being promoted through high-technology parks. The Shenzhen special economic zone in southeastern China is the site of a high-technology park established in the mid-1980s. From 1985 until 1993, about US$150 million was invested to develop an advanced information infrastructure in Shenzhen including telecommunications, data networks, and electronic data interchange (EDI). Shenzhen has more than 500 IT companies, including leading Chinese PC and components makers such as Great Wall and Legend. Shenzhen is also the leading site in China for foreign production of liquid crystal displays. As of 1991, there were more than 150 software companies in Shenzhen, but total employment was only 2,000 employees, an average of less than 15 employees per software firm. Most of these software companies, as in the rest of China, develop custom applications for individual local enterprises. Only a few companies involve joint ventures to develop software for domestic use and export, localize the software and manuals of multinational computer firms, or "body shop" programmers for foreign firms.

Another technology park is Shanghai's Caohejing Hi-tech Park, opened in 1988 with support from 13 research institutes. As of 1991, Caohejing had attracted 29 foreign joint ventures with the 37 state factories already operating in the area before the park opened. Total
investment in these ventures was US$310 million, with US$190 million coming from foreign investors.

Other technology parks have been announced across China, apparently with the idea of spreading the Shenzhen and Shanghai models to other regions. It is not clear, however, that many other regions have the basis for developing successful high-technology industries as do Shenzhen, with its location in the internationally-oriented industrial base of coastal south China, or Shanghai, which is considered to be China's leading commercial center. The government's plans appear to be based on political considerations, primarily the desire to keep the provinces happy and spread some of the benefits of economic growth around the country.

5. Provide Datacommunications Networks

Because MPT has not been able to provide the high capacity data networks needed by ministries and enterprises, many have built their own. These include the Ministries of Railroads, Electric Power, and Customs, as well as the Bank of China, the People's Liberation Army, and the State Information Center. MEI has set up a new company called the Ji Tong Corporation to work with these agencies to tie their networks together into an interconnected data highway. MEI has also set up China Unicom in conjunction with the Ministry of Railways (MOR), Ministry of Electric Power (MEP) and thirteen other shareholders to use the spare capacity on MOR and MEP networks. The plan is to provide long distance, local and wireless services to those places where the public telephone networks, provided by MPT's new state enterprise—the Directorate-General of Telecommunications (DGT), cannot reach or seriously lack capacity. However, speculation is that Unicom will become a major competitor to DGT in telephone service.

POLICY OUTCOMES: IT USE AND PRODUCTION

IT Use in China

The hardware market. Computer use in China was hampered in the past by its own policy of self-reliance and by Western restrictions on the sale of computers to China. In 1980, China began to import foreign computers and software products for use in business, banking, and
State information gathering. By the end of 1983, the total installed base was 4,545 mainframes, minicomputers and workstations and about 30,000 PCs. Overall growth in computer use has continued steadily ever since (Figures 3 and 4).

The computer hardware market in China is heavily weighted toward PC use. Sales of PCs in 1992 were nearly twice the combined sales of mainframes, midrange computers and workstations (Figure 5). The leading suppliers were AST Research, with 26% of the market and Compaq, with 17%. The leading Chinese suppliers are the Great Wall Computer Corporation, with 10% of the market and the Legend Computer Group, with 9% (both under MEI). Over half the market consisted of Intel type 8088 and 286 machines, putting China several years behind the U.S. in adoption of new technologies. Less than 15% of PCs in China are connected to local area networks (LANs), with the number of networked PCs growing 12-15% per year. About 300,000 PCs were installed in 1993, mainly 286 and 386 models, with future growth expected in 386 and 486 machines.

The software and services market. Compared to hardware, the software and services market is small, comprising only one-fourth of the total market, but growing at more than 20% a year (Figure 6). The PC software market was estimated at US$108 million for 1991, with US$49 million Hanzified, US$31 million domestic, US$23 million American and US$6 million other foreign software. Hanzified software, which is the bulk of the installed PC software, refers to software that has been modified to accept Chinese character input. It usually is modified without the permission of the original developers, full of bugs and one-to-two versions behind the U.S. releases. The most popular application programs are Chinese character input and word processing systems, followed by spreadsheet and database management systems.

Comparison with other markets. The Chinese computer market is still tiny relative to the size of the country's population and its economy. Relative to its population and GDP, China's
level of installed computing capacity falls far behind the newly industrialized countries (NICs), and is even slightly behind the other developing countries in the region (Table 2). At its present growth rate, it will take decades for China to catch up with its neighbors as a user of IT. However, these figures can be misleading. Most IT investment is going into commercial organizations (public and private) in urban areas, and will continue to do so for the next decade. The level of IT use is undoubtedly much higher in the modernizing sectors of the Chinese economy and among educated urban elites. The people and institutions that are leading China's advance into the international economy are rapidly adopting IT as a tool. The spread of IT throughout the country will most likely follow the patterns of economic growth and expansion of the telecommunications network.

[Insert Table 2 here]

In the past, export of computers to China from the West were restricted by the Coordinating Committee for Exports to Communist Countries (COCOM). COCOM was abolished in 1994, but technology exports to China from the U.S. are still subject to restriction by the U.S. government. Exporters have to get permission for any shipments of products on the restricted list, which includes computer equipment. These restrictions have been eased, allowing computers based on powerful chips such as Intel's Pentium (but not DEC's Alpha) to be sold in China.

**IT Production in China**

**Hardware production.** The computer industry in China is small, but growing rapidly. There are no general purpose mainframe manufacturers. There is one minicomputer joint venture with DEC making PDP-11s and VAXs. The remainder of China's computer makers are PC and PC-component manufacturers.

Reliable data on domestic computer production are difficult to obtain. Available figures place domestic production of all types of computer equipment in 1992 between US$1.2 billion and US$2 billion. Figure 7 shows computer hardware production from 1983-1991 according to the Chinese Academy of Social Science (CASS). The leading private sector domestic producer
is the Beijing Stone Group, which had sales of US$360 million in 1992. State-owned Beijing Legend Computer Group produced 40,000 PCs and China Great Wall Corp. produced another 20,000.

In 1992, the Chinese government created China Electronics Corp., or Chinatron, a conglomerate of 100 industrial enterprises, 37 research institutes, seven universities and other organizations. The conglomerate's 1991 revenues of US$3.3 billion equaled 20% of China's total electronics production. Chinatron has the look of a business conglomerate such as the Japanese keiretsu or the Korean chaebol, which transfer resources among their member companies and provide the financial power to undertake large capital investments and entry into new markets. However, Chinatron lacks the links to trading companies, banks and other industries which were important to the success of the Japanese and Korean groups.

Production of personal computers is expected to increase rapidly, reaching 1.5 million units by 1995. The rapid growth in production will be fueled by foreign investment as well as the growth of local companies. In 1993, Compaq set up a joint venture with the Beijing Stone Group (one of the largest and most dynamic non-state-owned companies) to jointly manufacture PCs. AST began producing PCs in 1994 in Tianjin in partnership with the Tianjin Kangda Industrial Company. Production from the plant is expected to be 100,000 in the first year and reach 200,000 by the third year. And in 1994, IBM and China's Great Wall Computer Corporation announced a joint venture to manufacture, distribute and service PCs in China.

**Software and services production.** Estimates from the Chinese Academy of Social Sciences place the output of the domestic software industry (about 216 enterprises) at US$31 million for 1991. Nearly all the output is Chinese language software. Sales of packaged software are limited by the prevalence of pirating, both for operating systems and applications. The value of custom programming is undoubtedly larger, but is difficult to ascertain as most programming in large organizations is done by in-house staff and boutique software houses. Multinational IT companies are beginning to look at China as a low-cost site for software development.
development. IBM China/Hong Kong has teamed up with the Bank of East Asia and the Shenzhen University Software Development Corp. to develop software products for IBM in both Chinese and English for worldwide distribution.

The Chinese PC industry and market are based on a Chinese version of the MS-DOS operating system, but it is reportedly difficult to find a Chinese company that is selling licensed operating system software. There are some UNIX, OS/2 and Macintosh users too, but they are a small minority. Microsoft waited until intellectual property laws were passed to enter the China market directly, but MEI was unhappy when Microsoft developed its Chinese version of Windows in Taiwan and Japan. MEI was also upset that Microsoft was taking the lead in developing standards for Chinese character fonts, rather than working with MEI to set non-proprietary standards. Microsoft Chairman Bill Gates visited China in 1994 to try to smooth over the problems, offering technology transfer and even speaking out in favor of renewal of China's most-favored nation status. Still, there is strong concern among government officials that China will become dependent on a software standard controlled by a U.S. company.

The ability of the Chinese to develop a software industry is limited mainly by the lack of a vigorous domestic software market. There is no real software market in China because software is copied freely even by government agencies and enterprises. China has very good software engineers and has developed many local software products, but no matter how good they are, it has been virtually impossible to distribute them profitably because domestic software is subject to the same indiscriminate copying as imported software. Until software protection laws are really enforced in China, it will be difficult to develop the domestic software industry.

**CONCLUSIONS AND ISSUES**

China's IT strategy has shifted from developing indigenous technological capabilities and producing a full range of computers to promoting IT use and producing PCs and components. Tariffs have been lowered to encourage use. Massive investments are planned to expand and upgrade the telecommunications network. To promote production, the government has set up
software parks, encouraged joint ventures with foreign IT firms, and put state computer enterprises on more of a commercial footing.

China's policies have shown signs of success, as computer use and production have grown dramatically in recent years. The key to the success of China's technology policy seems to be rooted in pragmatism. Policymakers appear willing to change and adapt when existing policies are not achieving their goals or when new opportunities appear. This type of flexibility is critical to responding to the rapid changes in technology and international markets.

If the trend towards increased market orientation and pragmatism continues through the transition to the post-Deng Xiaoping era, IT use and production should continue to grow rapidly. An improved information infrastructure and increased IT use can in turn benefit the economy as a whole by improving productivity throughout the economy and by making timely market information available to producers and consumers in the huge Chinese economy. In the process of realizing the potential benefits of IT, however, a number of issues must be faced by the Chinese government.

1. **Continuing reform of the Chinese economy**

   Rapid assimilation of IT and development of the IT industry requires a stable investment environment and further deregulation of the economy. Human and financial resources are available in China, but it is important that they be deployed effectively. This requires freeing up the labor and capital markets to better allocate resources. Wages need to be based on skill and productivity, and scarce capital needs to be invested in productive activities. Market incentives are necessary to encourage application of IT to increase productivity. A company with no real profit motive has no reason to invest in new technologies. The government will no doubt continue to play a major role in guiding the economy, much as other East Asian governments have done, but it needs to reduce its role as owner and producer. It also needs to develop a clear legal foundation of contracts and intellectual property protection, and enforce its own laws.

2. **Information versus IT**
The government is still trying to come to grips with how to deal with the information services sector, as it involves access to the many computer databases of the State Information Center and government ministries. The government has 20% of the information agencies in the country, but these control 80% of the available information or databases. The government's desire to maintain control over information can conflict with the objective of developing an information services industry. Services such as on-line databases are valuable tools for government and industry, but allowing more people (including those in other ministries) to have increased access to data could be threatening to various power elites in government.
3. **Policy coordination**

A major challenge facing China in developing and implementing IT policy will be the need for policy coordination. IT involves a broad range of policy issues, including trade, R&D, telecommunications and education. The experiences of Taiwan and Singapore show what can be accomplished when there is good policy coordination in government and cooperation with the private sector. Each of these countries has a strong coordinating agency for IT policy and each has become a major IT producer since the early 1980s. By contrast, Japan and South Korea continue to be plagued by bureaucratic infighting between their ministries of telecommunications and ministries of trade and industry.

China is encountering a similar battle between MEI and MPT. While MEI has the stronger position in the computer industry, it must compete with MPT over issues involving telecommunications. The huge investments planned for China's telecommunications network will create tremendous demand for IT products and services. Whoever controls those investments will have *de facto* control over much of China's future IT policy. Other competitors are the People's Liberation Army (PLA), which is moving aggressively to develop commercial enterprises, and the provincial governments, which are trying to promote local economic development. An example of the problems caused by the presence of multiple players is seen in wireless communications. The provincial governments would like to develop their own local wireless systems, but many have control over irregular slices of bandwidth which do not fit any international standards, so existing technologies cannot be used easily. The PLA, on the other hand, controls some of the best bandwidth. So development of wireless systems can require coordination among the provinces, the central ministries, and the PLA. Such coordination is difficult to achieve, at best. However, without some mechanism for coordinating policy, it will be impossible to implement a coherent strategy for IT, and China could continue to be beset by inefficient producers, duplication of R&D efforts, and the spread of incompatible technical standards among different regions and institutions.
The creation of ad hoc committees by the State Council is evidence that China's political leaders intend to try to force cooperation between the ministries. If this fails, one agency, such as MEI, might use alliances with other agencies and revenues from its associated enterprises to implement its own vision of IT policy. However, it is unlikely that MPT, the PLA or the provinces can be pushed aside easily. It is quite possible that IT policy in China will continue to be fragmented and uncoordinated for many years to come.

**OPPORTUNITIES AND CHALLENGES FOR FOREIGN COMPANIES**

The huge potential of the Chinese market makes it impossible for Western firms to ignore, even if they don't expect to make a profit there for years. The China market provides opportunities to maintain economies of scale in production, to amortize R&D investments and to establish technology standards in a major market. From a simply defensive point of view, no multinational firm can afford to be cut out of China and allow its competitors to dominate such a large market.

The large size of China's market does not mean that it is easy for foreign firms to make any money. Having superior technology or price-performance is not enough to win contracts. The government expects suppliers to provide financing, move production to China and transfer technology. Support from a company's home country government can be an important factor, and here the Europeans and Japanese have had a clear advantage over U.S. firms, as their governments have provided low cost export loans and other subsidies. The recent efforts of the Clinton administration to help U.S. companies win contracts in China may be balancing the scales somewhat.

Multinational corporations have been targeting every area of the Chinese IT market. IBM and DEC are leading suppliers of large computers and systems integration services, while AT&T, Northern Telecom, Siemens, Alcatel, Ericsson, Philips, NEC, Fujitsu and Motorola are selling telecommunications equipment and services. These giants are able to make long term commitments and develop a major local presence in China, and even then, they are often at the mercy of seemingly arbitrary government decisions. For example, in January, 1994, executives
from the major telecommunications firms were informed that MPT intended to cut its suppliers of transmission gear to three or four companies, after all had made large commitments to supplying the Chinese market.

The problems faced by foreign companies in the Chinese market are enormous. The red tape involved in making a sale can be endless. The devolution of power from the central government to the provinces is necessary to China's marketization process, but creates another layer of bureaucracy for approving projects. The People's Liberation Army controls tremendous resources, making it another force to deal with. In addition to red tape, the problem of official corruption is widely acknowledged, at least off the record, by foreign managers. While foreign investment and technology are seen as vital to China's economic future, officials have their own agendas, and it is difficult for foreign firms to satisfy the various demands.

Perhaps the most serious problem for foreign companies is the lack of intellectual property rights (IPR) protection. The Business Software Alliance estimates that China has a piracy rate of 94% for computer software, resulting in losses of US$600 million to the software industry. Comparable figures for other countries are 80% and US$1.9 billion for Japan, 84% and US$184 million for Taiwan, and 78% and US$646 million for Korea. The Chinese government has passed tough anti-piracy laws, going so far as to threaten the death penalty to pirates. However, when Microsoft sued state-owned Shenzhen Reflective Materials Institute for making 650,000 counterfeit holograms like those used on Microsoft's packages, the court awarded Microsoft just $5,000 in damages.

A recent article by Jeff Ubois refers to China as the "biggest, meanest market." The China market for IT is not the biggest; the U.S. is. Nor is China the meanest market. Iraq and North Korea are certainly less friendly. However, the sentiment is quite accurate in terms of the opportunities and challenges faced by foreign firms in China. To succeed, large companies must be willing to transfer technology in return for access to the market, a risky proposition in a place where so little protection of intellectual property is provided. Smaller companies may have to team up with larger multinationals, target individual provinces and try to develop distributor
relationships. Such relationships have proven quite successful in certain instances, but most industry sources indicate that in order for any firm to be truly successful in China, a company must get directly involved in the China market and demonstrate its long-term commitment to both its customers and to doing business in China.

**NOTE ON RESEARCH METHOD:** The research for this paper was conducted over a period of two years. It involved literature review, two week-long visits to China, presentation and participation in two key Chinese conferences (Informatization and Economic Development, November 1993; The Information Market and International Cooperation, October 1994), and interviews with about 50 people from industry, government and academia. It also involved collection of data from industry analyses, government statistics, and academic analyses of the computer and telecommunications industries.3, 6, 8, 9, 10, 11, 12
REFERENCES

1. Y. Han, "Nation's High-Tech Product Exports Grow Year After Year," Keji Ribao [Science And Technology Daily], Apr. 12, 1993, pp. 1.


10. IDC (International Data Corporation), China Informatics, IDC China/Hong Kong, Ltd., Hong Kong, Sept. 15, 1993, pp. 225-238.


### Table 1. Human Resources in Asia-Pacific Countries, 1993

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (millions)</th>
<th>Scientists &amp; Engineers (per 10,000 workers)</th>
<th>No. Software Professionals (1000s)</th>
<th>Software Professionals (per 1000 population)</th>
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### Table 2. Information Sector in Asia-Pacific Countries, 1993

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<th>Country</th>
<th>Population (millions)</th>
<th>MIPS per 1000 people</th>
<th>Computers per 1000 people</th>
<th>Phone lines per 1000 people</th>
<th>Hardware production (US$ mil)</th>
<th>IT spending as %GDP</th>
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Sources: Elsevier, 1994; Juliussen and Juliussen, 1994; Confidential industry sources.
Figure 1. China's Telephone Penetration, 1982-2000

![Graph showing China's telephone penetration from 1982 to 2000.]


Figure 2. China's Electronics Industry Production, 1982-1992

![Graph showing China's electronics industry production from 1982 to 1992.]


Figure 3. China's Total Computer Market, 1983-1995

![Graph showing China's total computer market from 1983 to 1995.]


Figure 4. China's Personal Computer Market, 1983-1995

![Graph showing China's personal computer market from 1983 to 1995.]

Figure 5. IT Sales in China By Type of Hardware (US$ million)

Source: Confidential industry sources
*Average annual growth rate.

Figure 6. IT Sales in China by Product (US$ million)

Source: Confidential industry sources
*Average annual growth rate.

Figure 7. IT Production in China, 1983-1993