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China: Steps Toward Political and Financial Reform

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China is ready to embark on its next revolution: the Information Age. The nation's economic reforms and the emergence of a market economy demand an efficient real-time communications network. Archaic switching and transmission equipment needs to be replaced, and a reliable long-distance network established. The entire telecommunications industry—including component manufacturing and system engineering and design, as well as network management and finance—needs to be brought to life. The scale of the effort is staggering, but China has high hopes for its telecommunications expansion.

When China ratified its seventh five-year economic plan in 1985, the policy blueprint formalizing its opening to the West, it sanctioned telecommunications as a national strategic priority. The following year, the first phase of the fifteen-year *China to the Year 2000*, telecommunications development study was made public. It stipulates that a minimum of \$22 billion will be spent to quadruple the number of local telephone circuits and to unify the national network. The broad goals and specific recommendations for industrial self-sufficiency are ambitious.

Telecommunications in China is crippled by three strategic weaknesses. First, there is limited vertical integration of local and toll services, which skews economies of scale in capital investments and revenue collection and leads to technical inconsistencies among regional networks. Second, R&D and telecommunications manufacturing are split hodgepodge between the Ministries of Posts and Telecommunications (MPT) and Machine Building and Electronics Industry (MMBEI), and the rivalry between them splinters already scant resources. Third, state funds, and especially foreign exchange for imports and joint ventures, are extremely limited.

Impending financial reform in the telecom sector, paralleling broader central government economic policy changes, will sharpen the crisis. Massive cuts in direct appropriations to industrial and service ministries will dramatically reduce capital commitments from Beijing to local MPT bureaus. In response,

municipal planners can be expected to manage phone networks as operating companies that issue bonds, raise rates, and, for the first time, come to terms with managing debt. The viability of this policy approach, which had gained both momentum and credibility in the late 1980s, has been called into question by the post-Tiananmen economic policies of the government of Li Peng. Politically, central government planners face the stiffest test yet to “socialist development with Chinese characteristics.”

5.1 Modernization Goals

The shortcomings of China's telecommunications are widely recognized. Nationwide telephone density in 1990 was only 0.75. In the countryside density falls to 0.17, the equivalent of one telephone for every 500 persons. Moreover, most of China's telephone stations are in offices.

Public access is generally provided by private leased lines managed by small cooperative or entrepreneurial enterprises. For example, a typical community telephone “company,” possibly a cigarette shop or a community high-rise bicycle garage, may manage two telephone lines for an entire neighborhood. Messages are posted on chalkboards or, luck permitting, runners search out the called party. In most areas only officials with deputy director status are entitled to private phone service; however, those with special political connections may possibly obtain a private line.

Public telecom services fall under the MPT. The MPT has exclusive responsibility for all international and domestic long-distance (interprovincial) calling. Regional and local networks are planned by local bureaus of the MPT; the exceptions are politically important minority regions, extremely poor areas, and the nation's borders, which are monitored by Beijing.

Strategies for the national network are devised in MPT's Department of Planning. The Long-Range Planning Division determines the national course; the Planning Institute crafts workable directives from long-range studies; and Import Planning sets line item priorities for major negotiations with foreigners. The Department of Policy and Regulation is responsible for policy analysis and overall strategic recommendations to MPT's minister. Via its academically oriented Research Academy, MPT also supports an important policy and econometric think tank known as the Research Center for Technical Economics, which provides quasi-independent reports and advice on timely issues.

China hopes to raise the number of telephones to 33.6 million by the year 2000 by adding at least 10–15 million virtual circuits or line equivalents to the approximately 11 million in place in 1991. Analog service is expected to be extended to the smallest towns. Digital switching and transmission corridors are slated to link provincial capitols and other big cities; fiberoptic and sophisticated switching systems will upgrade urban centers. Because China's own manufacturing capabilities are limited, equipment imports play an important role in network expansion. Still, about 1.4 million central exchange (“main

office'' or ''public switch'') lines were manufactured in China in 1988, although an estimated 90 percent or more of them were older analog technology.

To date China has been unwilling to import analog switching systems, largely in an effort to protect its own manufacturers and to save foreign exchange for digital machines. Budgetary constraints may force at least partial reassessment of this approach. Since 1985 donations of some 500,000 lines of older generation crossbar and step-by-step switching technology have been accepted from Japan's NTT, Singapore Telecoms, and Hong Kong Telephone, apparently with success. The market for sales of used equipment, however, is soft due to Chinese demands for operating system source codes and extensive training on product lines that are being discontinued (Chen 1988; Wen 1988).

The success of China's development program to modernize the network is contingent on a number of factors. MPT needs to assume a more balanced leadership role. The Ministry's principal charter is to engineer and operate the national toll network. MPT has oversight of provincial and local telecom bureaus, but not in operations management and local network growth decisions. MPT, as an organ of the central government, is generally reluctant to relinquish authority to provincial planners, as this would sap its ability to direct the national toll network. While MPT provides important technical guidance to provincial bureaus, its discretionary control over import duties, investment credits for capital plant expansion underwritten by the state, and more broadly, its power of veto on major network projects, often overrides the will of local planners.

A coherent policy for managing domestic telecommunications manufacturing must be adopted. China's industrial base is fragmented by regionalism, inter-ministry rivalries, inefficient labor and factory management, and an absence of reliable financing.

Local bureaus of MPT will have to boost internal generation of funds through more rational local tariffs and encourage municipal governments (and indeed the central government) to allow placement of long-term bonds. China's shortage of domestic capital and foreign exchange is a serious obstacle to growth, and reappraisal of the cost-pricing system deserves close scrutiny.

5.1.1 Services

Though MPT in Beijing is China's supreme telecommunications authority and the agent responsible for the nation's public trunking network, its role is more to lead a confederation of thirty separate provincial and municipal bureaus, each with virtually complete autonomy.

Local telephone service throughout China is a monopoly. A provincial authority usually has chief responsibility for local network development and financing throughout a region, characteristically defined by provincial boundaries. Local operators (hereafter referred to as *local PTTs* or ''bureaus'' for post telegraph, and telephones), which are organizationally a part of the MPT

in Beijing, expect administrative and planning freedom from the central government according to long-standing bureaucratic relations.

Bureaus are often more closely aligned with the municipal government than with the ministry itself. Depending on the size of the town or city, a bureau may be an independent entity, an office within the city government, or an affiliate of the provincial bureau. The nearer the city is to Beijing, the more likely it will ascribe to ministry planning sentiments, and the less clout local authorities will have. Informal social ties, true to Chinese bureaucratic tradition, contribute greatly to the distribution of political influence between provincial authorities and the ministry in Beijing.

Big cities characteristically have their own telecom administration, separate from the province. Guangzhou, for instance, maintains a bureau to manage local plant, operations, and billing. Guangzhou municipality, Beijing, Shanghai, the five special economic zones (SEZs), and, to varying degrees, the fourteen largest coastal "open" cities are permitted to spend foreign exchange much as they see fit, so they have considerable discretion in selecting equipment imports. Other regions must secure central government approval. (SEZs and "open city" status are intended to encourage foreign trade and investment; see, e.g., Reardon 1991.)

Provincial authorities hold ultimate responsibility for big equipment contracts, network planning studies, tariff structures, and other long-range issues. Poor or conspicuously rural regions may look to Beijing for assistance if the organization and resources of the provincial authority are not suited to assist local matters.

MPT is the only agency authorized to carry toll traffic, a situation that makes for extremely high call charges and the sluggishness associated with a monopoly. No competitors to MPT are expected to be approved by the State Council at any time before 2000, and probably not soon after that either. A new carrier, Hong Kong-based AsiaSat, was established in 1990 to provide nationwide telephony and television. Jointly owned by Hutchinson Whampoa, the China International Trust and Investment Corporation (CITIC), and Britain's Cable & Wireless, AsiaSat will lease capacity to the domestic toll industry, but only MPT will be authorized to collect revenues.

5.1.2 Network Topology

The topology of network expansion reveals Chinese planning ideology and intentions for information resource distribution. The network is developing in two dimensions, each with unique technical characteristics, development plans, and political and economic implications. The public network, sponsored largely by MPT and local bureaus, constitutes the interprovincial trunking routes, international dialing services, and local telephony. The public network, significantly, is in turn subdivided into urban versus rural areas. "Private networks," national in scope but catering only to the internal administrative needs of five

industrial and service ministries, are financed, planned, and operated independently of MPT.

5.1.2.1 The Public Network

The public network is managed as a utility; it is expensive, bureaucratic, and thus by definition hampered by insufficient funds. Affluent and relatively sophisticated cities are erecting modern networks based on the latest foreign technology, while poorer regions are making do with the basics. With reliable direct-dialing services urban users are beginning to regard the telephone as a vehicle of daily communication, at least in the work environment.

As usage rises, according to the prevailing logic, economic activity in the service area increases. The government hopes to spearhead advances in selected regions, which will in turn raise the overall capabilities of the network, thereby catalyzing cultural and commercial development. In essence, it is encouraging a technology and economic "trickle down" with Chinese characteristics.

The result is the formation of a two-tier network. Suburbs of cities with big construction budgets will benefit; most areas will have to wait. Until recently, telephone service in China was consistent: It was poor everywhere. The coastal cities are presently installing sophisticated imported systems while the nation's agricultural interior lags far behind.

Network stratification poses important social and economic questions. Any municipality that can afford imported equipment can proceed immediately with modernization. Other regions must compete for an ever-shrinking share of central government spending, attempt a "middle-road" course for network development based on domestic analog technology if production is available, or simply postpone development of a local telephone infrastructure. The last implies economic and cultural isolation. Rural network development, for instance, has none of the fanfare and little of the potential associated with bustling digital expansion in the cities. Even though 80 percent of the Chinese population lives in rural areas, rural network growth is expected to be modest. Before 1949, telephony in the hinterlands was nonexistent.

There is also the question of who gets access to the added lines. The waiting list for local service is estimated at 850,000, with 100,000 or more backlogged requests in Beijing alone (Chen 1988); the numbers would be higher if the public believed it was realistically possible to obtain service. Furthermore, distinction can be made among different "classes of service" actually received. With various grades of equipment being installed, priority calling status on quality equipment can be assigned only to those customers sufficiently well-connected politically. As a result, some users get instantaneous local dial tone and direct long-distance dialing over digital circuits, while others wait for lines on crackling and decrepit systems.

Information technology presents special difficulties for the Chinese socialist concept of public resource distribution. Although the state has had some success in providing public transportation, basic health care, and shelter, China simply cannot afford to provide every household with a telephone. The implication is disturbing. With access to effective telecommunications comes access

to prosperity, social mobility, and virtually limitless horizontal communication within society.

Consider the discrepancy: A small packaged-goods enterprise in Nanjing is granted a clean local trunk with which it can price raw materials all over Jiangsu province. A competing enterprise, perhaps on the wrong side of a new central office exchange, can scarcely call across town over a single faltering or perennially blocked line. One firm can meet the dynamic demands of the emerging market economy, the other lags sadly behind. On the individual level the discrepancies of network access can be more poignant still: One person learns to perceive time and space, and indeed social access, as variables subject to that person's manipulation, and to regard the telephone as a tool for broader communication and personal growth. A cousin, with no access to or context for a telephone, lives a social and economic reality bound by the confines of the village, an outsider to many of the changes sweeping the country.

The great thrust of telecommunications expansion in China is to upgrade the business and administrative environment; most new local exchange lines are installed in government agencies, institutions, or businesses. The Western goal of universal service—that every citizen is entitled to affordable telephone service—is not a publicly stated goal of the MPT, nor is it likely to be for another decade or more.

5.1.2.2 Private Networks

The second dimension of Chinese telecommunications is the development of private, or overlay, networks operating independently of the MPT. Beginning in 1976 the central government granted permission to four ministries—coal, petroleum, railways, and water and power—to build their own nationwide systems to accommodate internal communications. It was widely recognized that the public network was a liability to effective communications, a critical consideration in the wake of the cultural revolution. At the time, the Ministry of Railways and the People's Liberation Army (PLA) already had systems in place. Interconnection between the various private networks and the public network is limited; only Railways and the PLA have formal interfaces, and these are few.

A number of additional systems emerged during the 1980s: the Ministry of Broadcasting operates an extensive microwave and satellite network to carry television signals, and the Bank of China is attempting to establish real-time links among primary banking centers in all thirty provinces. Smaller networks are employed by a number of others.

The private network development strategy is vital to the full-scale modernization of the economy. The intention is to streamline the state's ability to manage its industrial and commercial interests in a manner similar to a Western business conglomerate. Each ministry can be viewed as a separate business line, headquartered in Beijing, that contributes to the government's centrally planned bottom line. With economic decentralization racing to divest operational control from Beijing, ministries need national management information systems (MIS) to keep track of geographically disperse business concerns.

Without MIS to keep planning policies in line, ministries and, indeed, the

central government itself, could lose more control over profit and loss centers (provincial or outlying offices, factories, independent enterprises, and cooperatives) than intended by the reforms. Beijing's economic initiatives are meant to stimulate production and to introduce responsible business management at the local level, not to disintegrate the power of the party or the state. The private networks are insurance that all roads will continue to lead to Beijing.

By leaving private network development to the individual ministries, the government is not obligated to underwrite network capital spending. In some cases, however, it will provide some funding, and it can concentrate instead on the national plan. By dedicating networks to unique business concerns, managerial efficiency is stimulated and accountability of regional enterprises to Beijing is improved. Like corporate networks elsewhere, China's private systems will probably remain relatively independent of the public network, both because MPT cannot itself shoulder the cost of development, and because the ministries are keen to preserve autonomy. The Ministry of Railways, which controls some 5–8 percent of all operating circuits in China, is estimated to have the largest of the private networks.

While not yet national networks, several major on-line processing systems have been inaugurated. The State Economic Commission will spend an estimated \$1 billion by the end of the century on a wide area network (WAN) and office automation system linking major commercial centers. Xinhua, the national news agency and political tool of the Party, is putting a vast distributed processing network in place. MPT is installing an X.25 packet switched network with primary nodes in Beijing, Guangzhou, Shanghai, and several additional centers. The system will create a high-density traffic corridor; services will be marketed by the Beijing Telecommunications Authority to end users and government agencies.

5.2 Organization and Political Control

Decision making in China is complicated. A number of groups and individuals are inevitably involved, and it is rare that any one single group has definitive power to champion and approve an initiative. According to central government officials, decision makers often only have the power to negatively influence decisions; few, even at the highest levels, have power independently to approve projects.

Telecom equipment manufacturing is a fragmented, sometimes bitter, competition between MPT, manufacturer of selected products, and the MMBEI, the State Council's favorite child and highly subsidized research center for components and software. The Ministry of Railroads manufacturers almost all of its own equipment and runs several of its own telecommunications colleges. Despite formidable engineering and labor resources, China can report few economies of scale and only poor or insufficient synergy between R&D, product definition, and manufacturing (see, e.g., Zita 1988b, pp. 2–15).

The current strategic framework for electronics was formulated by the Group

for the Revitalization of the Electronics Industry (also known as the Electronics Leading Group, ELG), a council of high-level technocrats within the State Council, during the group's 1985–1988 tenure. Under the leadership of Li Peng, who was subsequently premier, the ELG set the strategic path and development priorities for telecommunications, computers, software, integrated circuits, and electronic sensors. Although it has been functionally disbanded and its members reassigned to previous work units (only a skeleton staff remains), the ELG has left an indelible mark on the industry's future.

The ELG's conceptual recommendations, such as limiting the number of foreign electronics suppliers and targeting specific technologies for exploration and growth, are given tangible form by the State Planning Commission (SPC) and the Science and Technology Commission (SSTC). SSTC recommends how R&D funding should be spent, while SPC actually controls budgets. In late 1984 SPC sought to ease the rivalry between MPT and MMBEI by parceling specific R&D tasks to each. The compromise was for MPT to be the primary user of equipment and MMBEI the primary manufacturer.

Nonetheless, MPT will continue to manufacture a great deal of equipment. It makes most CO items and PABX, and it is a major supplier of optical electronics and line multiplexer equipment. MPT manages China's only operational digital switching facility, the Shanghai Bell Telephone Company. This is a joint venture set up in 1983 with ITT's Belgium subsidiary, which is now part of Alcatel. MMBEI is the country's largest producer of wire and cable. It also makes approximately 90 percent of all telecommunications components—ranging from mechanical relays and printed circuit boards to capacitors, transistors, and integrated circuits—and is an important joint venture partner for many foreign suppliers. Thus, it is slated to boost central office production with facilities being developed with Siemens and NEC. MMBEI's finished equipment is sold chiefly to the military and private networks; in contrast, MPT's systems are installed almost exclusively in the public network.

Under SPC–ELG guidance, a program has evolved to support “leading” research institutes and factories that pursue key development projects. MPT's Research Institute 1 in Shanghai, for instance, is slated to become China's foremost domestic PABX design center; MMBEI's Factory 738 in Beijing is destined to be the core for new research in large switches. Similar assignments—in some instances more than one—have been made for all strategic technologies: lightguide fiber (MPT in Wuhan and Shanghai), satellite earth stations (MMBEI in Nanjing), PCM (MPT in Chongqing); application-specific integrated circuits (MMBEI in Beijing and Nanjing), and so on. Leading research and manufacturing sites are reported to all have ample budgets, access to foreign exchange, highly qualified staff, preferential taxes, and, frequently, permission to license technology from abroad (see Zita 1988a).

Assignment of government-sponsored leading enterprises and factories contrasts sharply with the usual industrial structure. Ministries and municipalities have historically encouraged local self reliance, a strategy that surrendered manufacturing efficiency to community rule. Crossbar switch factories can still be found that also build assembly line machine tools and test equipment, as

well as turning out postal delivery bags, sewing machine motors, household lamps, and whatever else was needed or independently profitable.

Leading research and production centers are meant to encourage R&D and factory floor specialization, coordinate talented personnel, and dissolve ancillary activities. If pursued with conviction, the "leading site" strategy may, by investing in organizations most likely to meet technological and commercial success, establish better linkage between research, competent factory management, and production.

Responsibility for actually implementing ELG-SPC policy rests largely with MMBEI. However, it has no clear bureaucratic mechanism to coordinate planners, R&D facilities, and factories in large-scale projects. Sector planning is rare and inefficient where it exists. The ministry can encourage limited association among affiliated factories that are managed largely as independent enterprises, but lack the managerial infrastructure to marshal major development efforts. Planning decisions are often made according to strict financial considerations—that is, who has foreign exchange—and not, in line with SPC "leading site" recommendations, according to carefully considered research and manufacturing efficiencies.

A case in point is a joint R&D and planned manufacturing venture for a small central office exchange between Italtel, the Italian national supplier, and MMBEI Research Institute 54 in Shijianzhuang. Following ELG's advice, the State Council limited the number of central office joint ventures to three. These are with Alcatel at Factory 520 under MPT, Siemens at Factory 738 in Beijing, and NEC at MMBEI factories in and near Tianjin. Feeling left out of the market, Italtel appealed to the government by proposing a joint project to design and eventually manufacture a small rural central office exchange. The Italian government made a soft loan to underwrite the project available, thus effectively maneuvering through restrictions established by the central government bureaucracy. In this way, a fourth switching venture was consummated without violating established rules.

MPT's manufacturing is managed by the Posts and Telecommunications Corporation (PTIC), presently a wholly owned subsidiary. Factories are being granted greater control over operations; in the future, the twenty-seven factories directly under PTIC and its 100 factory affiliates will be managed as increasingly independent enterprises. MMBEI's more than 1,000 factories have already been fully divested, and only R&D and overall strategic and production planning are guided by Beijing. The goal of decentralizing management, reflecting changes elsewhere in the economy, is to bestow responsibility for profit and loss to locations where work is done and to boost production incentives and efficiency.

5.3 Research and Development

China's emerging industrial policy for information technology calls for the commercialization of basic research combined with limited strategic alliances with foreigners. The state realizes the shortcomings of its domestic industry, as

well as the importance of both moving its own R&D talents into the marketplace and acquiring technology and research methods from abroad. China, however, is keen to avoid the branch plant syndrome—assembly rather than true R&D—that it feels characterizes other newly industrialized parts of Asia. Furthermore, China wants to acquire foreign technology but keep its own R&D independent and developing. (This section is excerpted in part from Zita 1987, Chap. 6).

In the early 1990s the scientific and technological community is still reeling from the impact of the cultural revolution. Advanced research with the exception of certain military projects was brought to a halt between 1966 and 1976, a critical period in the global development of digital electronics. As a result, Chinese information technology is two or three generations behind the West. The engineers and technical workers who suffered the most have lost ten years of research and experience; they are now holding senior and middle management positions.

Recovery is complicated by deep-seated currents in Chinese science and technology in general. Science and basic research have traditionally enjoyed high status, business and applied science have not. One reason for the dichotomy is a distinction between a quest for knowledge and a search for practical application. Technology is the business of packaging the fruits of scientific endeavor, not of seeking truth. Like traditional Chinese military science, technological modernization with Chinese characteristics attempts to absorb Western technology without absorbing too much of its culture.

Deng Xiaoping has said, “We study advanced technology, science, and management to serve socialism, but these things do not by themselves have a class character.” This is not quite true. Technology is a highly political activity, and the managerial systems that gave rise to it, and the social context in which it is employed, reflect highly particular organizational philosophies. To make the step into the information age, a technology management infrastructure has to be created, and it will have to be borrowed from abroad.

The general disdain for technology has several consequences. Advances in basic research do not effectively lead to product innovation. There is no adequate product development cycle from conception to approval, prototype, testing, and production for important developments. With no technology management, good ideas often never leave the labs. There are no formal mechanisms for the diffusion of innovations. Technical advances and transferred foreign processes and products often stay within the group first adapting them, leading to duplication of research efforts, wasted capital, and limited market penetration.

In addition, China suffers from poor allocation of trained personnel. Due to vertical segmentation of industries and long-standing policies regulating worker assignments, the R&D environment is not conducive to the cross-fertilization of expertise. The problem is compounded by increased competition and protectionism among newly privatized independent research institutes.

Both MPT and MMBEI, or their subsidiaries or affiliates, are attempting to develop optical electronics, digital microwave, and packet switching in addition

to mainstay technologies; each is striving for technological breakthroughs to earn "leading site" status and the privileges that go with it.

5.4 Investment

With no appreciable rate base and no internal generation of funds, capital formation is among the industry's greatest challenges. Less than 1 percent of the state's fixed investment is committed to telecommunications; a severe shortage of foreign exchange curtails imports.

In 1987 MPT's net investment in telecommunications was \$323.4 million, half of which came from bank loans, a sixth from MPT profits, and the balance from direct investment by the central government. State spending on the public network during the seventh five-year plan (1986–1990) will total \$1.6 billion. By the year 2000, cumulative spending may total \$21.7 billion (growing fastest in the late 1990s). Additionally, some \$3–7 billion will be spent on private networks, coming exclusively from the relevant ministries.

5.4.1 *Financial Considerations Affecting Industry Growth*

Though telecommunications is typically a hugely profitable business, making money has consistently eluded the Chinese. Long-distance services generate the bulk of MPT's revenues and more than 40 percent of its profits. Local service revenues, which the ministry earns through yearend taxes, are nearly as large. Additional telephony services contribute little to the bottom line: telex is just barely profitable; data transmission is a cost center; fax has not yet matured; and feature group dialing (Centrex), teleconferencing, and other value-added features remain ambitious projections, and are only emerging in the biggest urban centers. The only sector to lose money in 1986 was the Postal Service, which, like European PTTs, is heavily subsidized by profits from telecommunications; the ministry maintains a consolidated balance sheet between the two.

MPT provides most of the financing for the national network, including long-haul cable and microwave routes, satellite earth stations, and tandem switching centers. Additionally, MPT meets up to 70 percent of the cost of combined tandem-local switching centers or cross-provincial transmission lines, with the local telecom authority putting up the remainder. Service revenues are distributed in the same proportions. By investing in combined local-toll equipment, MPT insures consistent trunking characteristics and maintains a presence as an equity shareholder in local network development.

More significantly, MPT makes available quotas of hard currency so local PTTs can convert local currency (yuan) to foreign exchange at the official rate. When MPT underwrites capital allotments through quotas, it automatically assumes an active role in contract negotiations and system selection. MPT foreign exchange quotas are a major force in purchase decisions though information regarding the size and conditions for the allotments is closely held.

International and domestic long-distance revenues are retained by the oper-

ating bureau and taxed at yearend as part of total earnings. Because international calls are paid to the local operator in foreign exchange, but taxed by the ministry in yuan, the ministry takes a loss with each international call. If an international call originates in a joint venture hotel, the local PTT is also paid in yuan.

Taxation is very complex. The overall burden is far less than what is typically collected from other industrial enterprises in China. The lower rate was established in light of telecommunications' high infrastructure costs and politically capped service rates. In the future, taxes will likely be managed by local agents; profits from local operators will be taxed by local governments, profits from intraprovincial services will be taxed by provincial governments, and so on. Some rationalization of international call revenues can also be expected.

A monumental shift is afoot in the financing of local networks. Before the early 1980s Beijing covered up to 60 percent of capital costs. This proportion will be drastically reduced in some areas to as little as 10 percent in the eighth five-year plan (1991–1995). (This point, and several that follow, emerged in discussions with authorities from the Guangdong Provincial Posts and Telecommunications Bureau in December 1987.) The balance in local budgets is slated to be made up by loans and foreign funding of one sort or another. The ministry, for its part, will seek to reduce its dependence on debt by making local operators responsible for their own borrowing. Table 5.1 compares Guangdong financing sources with World Bank programs in Africa.

The transition from appropriations to loans will slow local expansion. Just when plant costs are projected to soar, subsidies from the state will be cut, and a new cost—capital—will be added to the local load. The result is clear: Telecom operators collectively and individually are going to go sliding into debt. As inflation surged—the official figure was 18.5 percent for 1988, but economists estimate it was closer to 30 percent (Nakajima 1989, p. 2)—the central

Table 5.1. Distribution of Financing Sources*

World Bank ^a	Guangdong 5-year plans ^b		Source
	Sixth	Eighth	
45	20	10	Internal generation ^c
23	0	20	Bilateral and commercial
15	0	0	Multilateral
13	60	10	Government
1	10	10	Subscribers
1	10	50	Other (including debt)

Source: World Bank and Tetra International estimates.

*Data are given in percentages

^aData are for ten projects in Africa, each about \$500 million.

^bThe sixth plan covered 1976–1980; the eighth, 1986–1990.

^cFor China, revenue bonds as well as operating profits.

government restricted money supply, thereby tightening credit. Traditional sources of financing—fees, loans, and local investment—present special difficulties, and each must be addressed in turn.

5.4.2 Installation and Service Fees

In many regions—such as Beijing, Shanghai, and Shenzhen—the prevailing logic guiding installation fees is that new users must pay exorbitant charges to finance plant expansion; high fees effectively pay for the local loop. In Beijing the cost to initiate new service is about 5,000 yuan (\$1340)—the equivalent of nearly five years of an average worker's salary.

Costly access charges address PTT's short-term capital needs, but they obscure long-term strategic interests. Common sense shows an operator's strongest source of revenues and highest potential for gains lie in services. Instead of squeezing new customers dry, Chinese PTTs would do well to encourage wider penetration of telephones and fund infrastructure expansion through a wider base of value added fares, particularly Centrex and private leased lines.

Not all areas are the same. Planners in Guangdong are striving to make initial connection charges affordable. Mindful of the traditional U.S. policy of universal service, Guangdong has initiated an ambitious, if modest by Western standards, effort to subsidize installation fees and pick up the budget slack elsewhere. The vision is admirable. Guangdong, of course, is one of China's richest provinces and so can afford to tariff installations on a sliding scale according to economic ability or contribution to the community. Installation costs in the late 1980s are shown in Table 5.2.

That some users pay more in the local network development phase is justified because everyone can be connected more quickly (Wellenius 1987, p. 43). A proposed alternative to offset initial user charges being considered in Guangdong is to reimburse some percentage of installation fees after a set number of years. In this way wealthy enterprises essentially make a mandatory investment in the local operator in order to receive local service.

Local service tariffs use the value of service concept and thus bear little relationship to cost. Basic rates for basic phone service (POTS) are consistent

Table 5.2. Line Installation Charges, Guangdong

Charge	Location
none	Remote
135	Urban ^a
539	Colleges, research & public welfare institutes
1,078	Enterprises

Source: Tetra International

Data, given in U.S. \$, are for an unspecified year in the late 1980s, converted at the then-current exchange rate.

^aFor a household. This was equal to about 45 percent of an average worker's annual wage.

everywhere, since they were set by the State Pricing Commission using an odd calculus based on the size of the calling area. While administratively simple, the method obscures qualitative distinction between different types of technology: 10,000 lines of imported digital equipment costs a PTT three or four times as much as 10,000 lines of domestic analog equipment.

To build local revenues, PTTs need to pay closer attention to the variable rate scales inherent in different classes of service. If the price of a local telephone call were increased by a factor of three, to 15 fen (about 2.5 cents), the resulting revenues would be negligible and the public would be furious. A more promising solution is to promote penetration of PABX lines. In Shanghai in 1988 a standard local trunk earned the Bureau 12.5 yuan a month; a private branch exchange (PBX) trunk earned 70 yuan (about \$19 at the time). Similarly, business services, such as leased and fax lines, IDD, cellular radio, and Centrex are expected to be introduced as soon as local economies can bear the cost.

Bill notification and collection are huge problems. Manual bill processing, minimal consumer credit and checking facilities, overcrowded payment centers, slow bill delivery, and account monitoring all contribute to tardy bill collection. The possible expansion of MPT's postal savings system, operating out of MPT's 14,000 local postal offices, could conceivably be employed to resolve aspects of these bottlenecks.

5.4.3 Domestic Loans and Foreign Borrowing

Local planners are nervous about the impending reliance on borrowed money, but they are positively shaken by the foibles inherent in transactions with the Bank of China (BOC). Few standards prevail.

As foreign corporations are well aware, BOC has its own, idiosyncratic way of doing things. It is even more fickle with Chinese clients. MPT bureau officers say they cannot rely on BOC to renew existing loans, let alone to insure a fivefold increase in borrowing in the near future. MPT bureaus must continually haggle with the bank over commitments, extensions, and terms of payment; they do not know with certainty if needed funds will be granted.

Moreover, terms of the money are anything but attractive. No low-interest loans exist in China. There are two options. Preferential loans, at 6 percent over ten years, made available by the Construction Bank of China, a part of BOC's system, is one. The state loans the money to the bank, which loans it to MPT. Such loans are awarded infrequently and apparently only to priority development projects. BOC loans, at 8 percent over three years are made through the Industrial and Commercial Bank.

Given the impending reliance on debt, planners feel that they are in a somewhat desperate predicament, and rightly so. Local PTTs are likely to get short-shrift; individually they will not have the same bargaining power the ministry does. Talks are underway with BOC to lengthen payback periods for infrastructure-related projects, including all telecom ones, but no fast action is anticipated. China's entire financial system is slated for thorough overall, but

its specific direction is contingent on the strength and vitality of the central government's economic reforms.

In the meantime, PTTs make ample use of bilateral and development loans secured by foreign governments. Generally speaking, a government-finance, commercial or foreign affairs agency makes a state-to-state or state-to-province development grant for a minimum of 35 percent of total contract value, a level set by OECD-donor consensus; this money is then mixed with commercial or state bank loans. Such concessional financing (soft loans) insure the cost of capital to the Chinese customer is minimal. Concessional financing has evolved from a tactical advantage for foreign suppliers during 1985–1986 to become a *sine qua non*.

The amount of government-sponsored bilateral or trade assistance loans varies by government and industrial sector. Sweden underwrote telecom contracts during 1980–1989 worth \$183 million. Soft loan telecom contracts with all countries combined during the period amounts to some \$728 million. This represents the fourth highest area of infrastructure soft loan spending, after electric power, chemical plants, and railroads. The United States is the only major industrialized country that does not offer mixed credits to China, and US market shares reflect this.

Multilateral development loans have not been employed in telecommunications, but both the World Bank and Asian Development Bank are investigating projects. China, which once sought to keep its international debt service to a minimum, seems inclined to use nonaligned bank funds. The most likely course for borrowing will be co-financing among the banks and Chinese financial institutions—perhaps BOC, China International Trust and Investment Corporation (CITIC), or an all-new partner. Co-financing shares risks and eliminates third-party spending regulations. By contrast, a full-scale World Bank telecommunications investment project implies the bank determines precisely how funds are spent, something the Chinese are unlikely to accept.

Commercial credits from private foreign banks are likely to remain too costly in the foreseeable future. Likewise, supplier's credits, offered by big corporation's in-house financial services companies, are another, though even less attractive, option. Payback of supplier credit is customarily short at steep rates.

5.4.4 Local Investment

Depending on the political wind, MPT bureaus in larger cities may one day be allowed to obtain direct local investment from the sale of bonds and nontransferable public shares. The idea is to diversify fund sourcing throughout the local economy and to cushion dependency on financial institutions.

A first phase of raising local capital might be selling long-term bonds, as done effectively in Brazil, Thailand, and postwar Germany and Japan. With expanding budgetary power, local governments may find incentives and permission to boost public telecom spending by offering municipal utility bonds. PTTs might also require big customers with special network needs buy PTT bond as a condition for service.

To prepare for the financial challenges that lie ahead, local PTTs must become organized as formal corporations. *Corporation* here does not necessarily imply private enterprise. Rather, PTTs will need to establish stable organizational structures capable of diversified borrowing, debt management, and near- and long-range business planning. MPT is hesitant to relinquish control over local operations, and the ministry's centrist influence often muddles rational reorganization. Inculcating corporate structure in local operations long accustomed to haphazard bureaucracies bespeaks a revolution. Nevertheless, a management revolution may be required to safeguard PTT cash flow from collapse.

Taking on formal shareholders might also help curb corruption; however, payoffs for network favors are common. A local bureau may receive a truckload of sugar cane, several hundred pounds of cabbage, or simply cash as companies or city districts seek to buy insurance for their needs. A whole community may take part; *guanxi* (connections) are renewed, friends are bought, and, in theory, services delivered. MPT telephone installers are also notorious for extorting bribes.

5.5 The Role of Foreigners

In its dealings with foreigners, China, simply speaking, is seeking sophisticated hardware to upgrade existing facilities quickly and technological know-how to broaden the scope of the emerging industry. To obtain whole systems immediately, China has no choice but to buy the equipment outright. To garner manufacturing, managerial, and applied research expertise, China must over time develop long-term associations with foreign firms. The former relations are strictly commercial; the latter entail multiyear licensing contracts, elaborate training programs, and partnerships in joint business ventures.

The Chinese and foreigners typically view business alternatives through different lenses, and their priorities are set accordingly. The Chinese want to acquire technology, preferably without paying for it, while foreigners want to sell products, preferably without releasing the secrets of the technology.

5.5.1 The Market

The China telecom equipment market is tiny by world standards—an estimated \$2 billion in 1991 (*Asian Business*, Nov 1991, p. 62). In 1985 total sales of foreign equipment amounted to \$300 million, about what an RHC in the United States laid out in six weeks. By the year 2000, cumulative investment will be valued at less than the U.S. market in 1988 alone. Nevertheless, foreign competition in China is intense. Suppliers want to believe sales will one day take off, or at least see China a critical test for future sales to the entire developing world.

In the first nine years after digital switching systems were sold to China (PBX [Private Branch Exchanges] in 1979, and Central office, CO, in 1980)

the market had hardly unfolded according to Chinese come-ons or Western hopes. Sales continued to be slow, and operating costs were high.

Competition is regulated. No foreign firm is allowed to garner "disproportionate" market share, based on commercial, diplomatic, and many other unpredictable considerations, without encountering stiff nontariff trade barriers. Fujitsu's impressive record in CO sales is a case in point. By mid-1986 the firm had confirmed orders of nearly 320,000 lines, more than twice that of Ericsson, the nearest competitor. Aside from installations in progress that year, no new shipments and no new CO sales had been made by Fujitsu through mid-1988. One reason for the standstill is the appreciation of the yen against the dollar, which has caused Chinese customers to balk at their reduced spending power for Japanese goods (the Chinese characteristically negotiate foreign purchases in U.S. dollars).

Equally significant has been deliberate Chinese market management. MPT has encouraged regional offices to demand renegotiated contracts. Currency fluctuations present an ideal opportunity for maneuvering, but the impetus for the Chinese position comes from a realization that their CO market was overwhelmingly controlled by a single foreign corporation, and worse, by the Japanese.

Opportunities for PABX imports are abundant as enterprises modernize office operations. The obstacle to the market fully emerging is the lack of formal distribution channels; PTT bureaus do not act as equipment resellers. The PABX landscape is changing dramatically, as eleven joint ventures or technology transfers with foreign firms have been approved. Analog PABX equipment, both new domestic and used from abroad, is commonly employed in public network applications. PBX in the local loop helps maximize line usage and, significantly, makes China's call-per-hour (line traffic rating) the highest in the world according to Ericsson executives.

Transmission equipment opportunities are more limited than those for switches. Stand-alone microwave sales grow increasingly rare in the public network, though many contracts are traditionally strong and have been augmented by a series of technology transfers from NEC. Imported radio links are periodically used in turnkey networks. Cellular radio potential is encouraging, although early configurations are small and expensive to operate. Party cadres and wealthy enterprises use cellular phones in at least four cities.

Wire and cable is a closed market. China's own capabilities meet domestic needs, in large part due to a huge joint venture with United Technologies' Essex. Fiber optics spell better opportunities, but the market is spun with extraordinary complexities. Philips and Furukawa both have joint cable ventures, and Philips may be in line for another. The great majority of the cable produced in these plants is committed to high-priority long-distance routes. Many opportunities exist for provincial and municipal networks as aging paper-sheathed cables corrode and the price of fiber falls. The Chinese often buy fiber optic cable through separate tenders; that is, a city's digital switch may be wired with another supplier's glass. This both escalates competitive stakes and creates after-sale opportunities for vendors who may have lost the primary contract.

5.5.2 Foreign Suppliers

Soft loans have meant sales. As a result, before 1990, Fujitsu and NEC were far and away the market leaders in CO equipment sales. Each had provided about 30 percent of the 1.6 digital public CO lines installed at yearend 1988; their shares of total telecom equipment were less. Alcatel's model E10B exchange dominates the network in Beijing and its Shanghai joint venture is producing the System 1240. Ericsson, which has been selling in China since the 1890s, has a secure market position, particularly strong in the south. The US does not give concessionary financing and thus AT&T has a small market share.

Other established major players are Northern Telecom and Siemens. By earlier 1989 two newcomers, GTP (GEC Plessey) and Nokia (of Finland), had penetrated the market as well. Prices were stabilizing, and customer's needs and purchase preferences had crystallized: In 1986, most users were encountering digital technology for the first time; three years later they were more apt to know what they wanted and why. China imported just over \$1 billion of telecom equipment in 1989 (*Far Eastern Economic Review*, Mar 7, 1991, p. 43).

In urban areas, some 60 percent of plant expenditures are made on central office technology; the remaining 40 percent goes toward transmission and the local loop. This proportion is roughly reverse in the countryside.

The value of CO imports had been steadily increasing prior to the June 1989 crackdown. Some 2.7 to 3.5 million lines were to have been shipped during 1988–1990, for a cumulative value of \$600–750 million. Imported and domestic CO lines combined thus should have topped 6 million new lines, double what was publicly announced.

Instead, new soft loans were frozen after Tiananmen, which meant foreign suppliers generally could not sign new contracts. This was a windfall for Shanghai Bell (and thus Alcatel). Production went from 190,000 lines in 1988 to 405,000 (twice the original target) in 1989 and 600,000 in 1990. Another 600,000 lines were expected in 1991—double the number originally put under contract. This has helped Shanghai Bell take a 40 percent share of the market for public network telephone exchanges, with 5.5 million lines installed or ordered in twenty-four provinces. (*Asian Business*, Dec 1991, p. 14.) By November 1990 loans had been renewed and suspended contracts were revived. NEC had approval for domestic digital switch production before Tiananmen, and has indicated it will proceed. Siemens reached a joint venture agreement in November 1990.

In 1985 the MPT reportedly began seeking to reduce problems with system incompatibility and servicing by cutting the number of foreign suppliers to eight, and in 1990 the State Council was said to have issued a directive limiting future switching contracts to Alcatel, Siemens, and NEC. In each case, market access was tied to transfer of integrated circuit technology (*Business China*, Dec 24 1990, p. 185). However, neither restriction actually seems to have been put into effect.

Optical electronics and data communications sales are sharply limited by CoCom, the Coordinating Committee for Multilateral Export Controls, NA-

TO's watchdog for sales of high technology to socialist bloc countries. The U.S. Department of Defense is adamant about restricting sales of high-speed optical equipment, particularly systems capable of transmitting at rates higher than 140 Mbps, much to the chagrin of suppliers of optical test equipment, components, and systems. The rationale is that the Chinese should not, from a strategic point of view, be allowed to establish a network with intelligent distributed processing hypothetically capable of sustained operation even after repeated nuclear blasts. A similar argument stands for distributed data networking.

A further CoCom concern is communications security. With modern interception and deciphering techniques, analog transmission signals can be easily intercepted and read. With high-speed fiberoptic connections that do not radiate signal information, and digital switching, which manages traffic flows, electronic eavesdropping becomes increasingly difficult. A liberalization of CoCom guidelines may be forthcoming. Much satellite and earth station equipment, particularly that with spread-spectrum frequency management, is similarly affected.

5.6 Conclusion

Telecommunications in China is tracking toward profound realignment. While the MPT in Beijing has the last word in questions of policy, political power is being devolved to local authorities, state funding is being cut, and technological modernization accentuates the disparities between the information haves and the have nots.

The MPT faces a difficult contradiction. While it acts as China's supreme telecommunications authority, it is not a nationwide monopoly; the influence it holds over local networks is subject to swings in political pressure. Provincial PTTs are still functionally a part of MPT, although rifts between Beijing and provincial capitals over development strategies and administrative policy are common.

With increased decentralization, local authorities can take responsibility for profit, loss, and develop into sustainable business enterprises. Corporatization and diversified debt management can wean PTTs from the parental care of the state and heighten incentives for improved productivity. After an initial period of confusion, and perhaps even panic as funding commitments from Beijing are withdrawn, local PTTs could become a driving force in the establishment of municipal capital markets. Telecommunications infrastructure development may thus become directly aligned with community modernization and not simply be an extension of central government policy. These scenarios, however, are largely dependent on the central government's macroeconomic policy and plans.

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