

Convergence and China's National Information Infrastructure

(M.Hukill, R.Ono and C.Vallath eds. *Electronic Communication Convergence: Policy Challenges in Asia*, Singapore, 1999?)

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The Ninth National People's Congress (1998) ratified a wide-ranging restructuring of China's state bureaucracy, including the merger of the ministries of electronics, of radio, film and television, and of telecommunications. It is tempting to see in the creation of the new Ministry of Information Industries (MII) a move towards convergence in policy and regulation of China's emerging electronic communications industries. One difficulty with such an interpretation is that it flies in the face of what can be construed as a bargaining model of China's decision-making process. A far more persuasive explanation of the creation and timing of the new ministry places it within the context of a more general overhaul of the state bureaucracy and radical pruning of the state budget. While the scope and scale of this pruning was given added urgency by the currency crisis which hit Asian economies following the run on the Thai baht in the summer 1997, the exercise itself must be seen as part of the longer-term reforms initiated by Deng Xiaoping, to create a 'socialist market economy' in China.

The creation of the MII would seem to consolidate the influence of the Ministry of Posts and Telecommunications (MPT) at the expense of the other ministries absorbed by the merger.² The relationship between the different ministries involved in China's telecommunications and information technology industries is explored with the use of a bargaining model in the first part of this chapter. The bargaining framework is introduced and the roles of the Ministry of Electronic Industries (MEI) and the Ministry of Radio, Film and Television (MRFT) are discussed in the historical context of China's emerging, and converging, information technology and service sectors. One of the points to be made is that for much of the period up to the creation of the MII, Chinese walls separated the administration of these sectors. At the highest level the bargaining model is really a description of how contending interests have been accommodated or reconciled at the level of the State Council, China's leading organ of government.

The second part of the chapter provides a structural overview of China's national information infrastructure (CNII) and the conceptual thinking behind it. The official emphasis now placed on the CNII is creating opportunities for the entry of new interests. They include both state-enterprises and entrepreneurial start-ups, especially in areas associated with the Internet and with on-line services. We conclude the chapter by noting the entry of the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) into the emerging market of electronic commerce. It therefore seems that the convergence of telecoms, cable TV, satellite communications and the Internet is giving rise to a re-ordering of influence and interests between ministries in China, and offering scope for new entrants beyond the state sector.

Chart 1 below provides an organizational introduction to the MII. It incorporates the functions previously exercised by the MPT, the MEI and the MRFTV and the Aerospace ministry.

<p>Chart 1 The Ministry of Information Industries</p>
<p>The newly formed MII has 13 functional departments and 320 staff, including one minister, four vice-ministers and forty-five directors.</p>
<p>The 13 functional departments are:</p>

- **General Office**
Daily operation of the Ministry office; conferences, public relations, finance and management of State assets.
- **Department of Policy and Law**
Research and formulation of general policies and major plans for reform; laws, administrative regulations and enforcement; research on policies regarding Hong Kong SAR, Macau & Taiwan.
- **Department of Planning**
Research and formulation of development strategy as well as medium and long-term plans for the development of electronics, telecoms, and software industries.
- **Department of Science and Technology**
Monitoring trends in international information technology; standards setting for telecoms and radio/TV network transmission; numbering; co-ordinating research and development; electronics quality control.
- **Department of Economic Reform and Operations**
Operations research and planning enterprise restructuring, including the formation of large groups; statistics, forecasting and market analysis; macroeconomic management of electronic information products and technology imports.
- **Telecommunications Administration Bureau**
Planning telecoms development and 'fair competition'; licensing; service quality and pricing; interconnection, inter-operability and account settlements between networks; numbering plan; domain name services; co-ordination of private telecom networks of government departments; international gateway management; security issues.
- **Department of Economic Regulation and Telecommunication Settlement**
Adjustment and account settlement implementing policies and laws on the management of state-owned assets and the accounting system; tariffs, billing and subsidies to service and postal sectors.
- **Department of Electronic Information Products Management**
Research and formulation of medium and long-term development plans, policies and measures for electronic industry and software industry; co-ordinating development of basic equipment and microelectronics products.
- **Bureau of Military Electronics Industry**
Management of military electronic industry
- **Department of Information Promotion (State Information Office)**
Research and formulation of plans for the promotion of an information-based national economy; providing assistance to major informatization projects; organising, co-ordinating and promoting the development of the software industry; policy and research for the development and co-ordinated utilisation of information resources; information systems security; public education on information development.
- **Radio Regulation Bureau (State Radio Office)**
Spectrum planning, management of radio stations, controlling electro-magnetic interference.
- **Department of Foreign Affairs**
Organising participation in international organisations and events.
- **Personnel Department**
Human resources management, training, and wage setting.

Functions shed:

1. Postal services taken over by the State Postal Services Bureau.
2. Telecommunications trunklines and local networks devolved to operators.
3. Management of industrial and materials enterprises and buildings.

Functions acquired:

1. The administrative function of the former State Radio Administrative Commission and its General Office
2. The administrative function of the former State Leading Group of Information Industry and its General Office
3. The administrative function of the former Ministry of Radio, Film and Television in the overall planning of radio and television transmission network (including cable TV network), industrial management, and organisation and formulation of technological system and standards of radio and television transmission network
4. The administrative function of the former Space Industry Corporation in drawing up development plans and technological standards for telecommunication and broadcasting satellite networks
5. The function of the former Commission of Science, Technology, and Industry for National Defence in co-ordinating the satellite orbit position domestically
6. The function of the former State Planning Commission in the management of public telecommunication service charge and formulation of basic telecommunication service charged standard

Bargaining Model³

The Ministry of Information Industries (MII), which absorbed the Ministry of Posts & Telecommunications (MPT), the Ministry of Electronic Industries (MEI) and the Ministry of Radio, Film and Television (MRFT) together with others,⁴ was created in 1998 as part of Premier Zhu Rongji's efforts to streamline and modernize the bureaucracy of mainland China through the closure, consolidation and merger of various ministries.⁵ At the core of the new ministry is the old MPT⁶ that exercised overall responsibility for policy, planning and development of the national public switched telecommunications network. The MPT also built, managed and operated domestic long-distance and international services through the Directorate-General of Telecommunications (DGT) until the DGT was officially spun-off as an independent body in 1994 and incorporated as China Telecom in 1995. The provincial Posts and Telecommunications Administrations (PTAs), which provided public service at the municipal, city and county levels, formed the local level of the MPT's hierarchy, although their close and inter-dependent working relationships with municipal, provincial and city-level governments give them a certain level of autonomy.⁷ The financial reforms of the late 1980s and early 1990s, which privileged the telecommunications sector and deliberately decentralized local loop management, substantially reinforced the tendency towards greater self-reliance and autonomy in investment and equipment procurement decisions.^{8 9}

The creation of China Telecom was a classic move to corporatization, offering greater managerial flexibility to cope with an increasingly commercial and competitive environment. The prospect of competition came from LiangTong or China Unicom, a protégé of the Ministry of Electronic Industries (MEI), Ministry of Railways (MOR) and Ministry of Electric Power (MEP) -- and twelve state-enterprise shareholders -- all rivals of the MPT in either the manufacture of network equipment or in the provision of networking capacity for public or third-party use. Although the short history of

Unicom has been chequered by frequent changes in management structure and personnel -- and often by a typically hostile reaction from the incumbent operator on issues such as interconnection, circuit provisioning, customer billing information and so forth -- Unicom has, through a series of joint ventures with foreign equipment suppliers and overseas cellphone operators, managed to build-out GSM cellular networks in 18 of China's 31 provinces¹⁰ and is laying the foundations for local loop fixed-line networks in cities such as Guangzhou and Tianjin. In addition to Unicom, by 1998 the MPT had to deal with the entry into the cellphone market of the Ministry of Defense/People's Liberation Army (PLA)¹¹ through a nationwide franchise awarded to the China Great Wall Corporation to build and operate a CDMA network.¹² In this case the MPT's strategy has been one of deflection, forming a joint venture with China Great Wall, thereby maintaining China Telecom's interests in both technologies and markets.

Ministry of Electronic Industries(MEI)

The absorption of the MEI forms the second component of the MII. For over a decade the MEI has been jealously eyeing the lucrative telecommunications equipment market, while the MPT has been busy fending it off. Ministries in China are vertically integrated, so the MPT had under its direction in addition to the long-distance carrier business, numerous equipment research and design laboratories, including research institutes and universities, equipment manufacturing, procurement and trading bodies, and, at an arms length, the provincial Posts and Telecommunications Administrations (PTAs) which replicated the central structure at the local level. After the state-controlled tobacco enterprise, the MPT has been the largest contributor to state revenues, and this fact alone gave the MPT considerable clout at the State Council level where lobbying and jockeying for position between ministries and state commissions takes place.

By contrast, the MEI had seen its mandate narrowed during the later 1980s, and its main market for telecommunications equipment shrink as the PLA began cutting its forces. The modernization of the PLA had been given priority by Deng Xiaoping and while this opened up a demand for high-end computer-based telecommunications technologies the MEI was not well positioned to supply them. It is worth placing this into an historical context because 'convergence' of technologies can also mean 'contradictory' or clashing interests as different agencies of the state compete for resources, areas of authority and influence.

Immediately following the 1978 Open Door policy, the State Science & Technology Council (SSTC) was re-established to co-ordinate overall planning of science and technology in China.¹³ At the same time the China Academy of Science (CAS) was reorganized and its departments increased from four to five to include technological science, while the China Academy of Social Science (CASS) was formed when the department of Philosophy and Social Science was separated off from the Propaganda Department of the Chinese Communist Party (CCP). As an independent research academy CASS brought professional training to the study of economic and state reform, and in the 1990s became increasingly involved in the study of telecommunications and information technology.¹⁴ In March 1978, Fang Yi, the minister of the SSTC and vice-president of CAS, unveiled a Ten-Year Plan 'Outline National Plan for the Development of Science and Technology, 1978-1985 (Draft)' at the National Science Conference which set ambitious -- *overambitious* -- targets to catch-up with the West in several areas of basic and applied scientific research and technology development, including computers and lasers. For example, computers were to be built from scratch, but this was effectively cutting off China's nascent computer industry from the transfer of technology and from world standards.¹⁵ From 1984 onwards, following the relaxation of US and COCOM restrictions on high technology exports and technology transfer to China, a much more

open policy was adopted and the industry began making strides into the domestic manufacture of international designs.

The ambitions of the Ten-Year Plan were modified by the new premier Zhao Ziyang in 1982 when he announced a shift in emphasis to technology transfer. He listed four dimensions of transfer: (1) from research to production, (2) from coastal to interior regions, (3) from defense to civilian sectors, (4) from overseas to domestic users. ('Speech at the National Science Awards Conference' *People's Daily*, 27 October, pp.1-3) A supra-ministerial body was formed in January 1983 reporting directly to the State Council, the Science & Technology Leading Group headed by Zhao. The Leading Group effectively replaced the SSTC as the arbiter of science and technology policy in China. Its significance lies in the fact that it was able to cut across rival ministerial interests.

The new emphasis was seen by the CAS and the defense interests as threatening funding for basic research, and their lobbying bore fruit in March 1986 when Deng consented to the '863 High-Tech Programme' which identified areas where Chinese scientists and technologists could close the gap with the West. The SSTC was responsible for the '863 High-Tech Programme', and projects were expected to bear commercial fruit within five-to-ten years. They included IT projects such as intelligent computer systems, microelectronics, information technology such as databases and search engines, and communications technologies. Communications technologies research really began in the early 1990s and included broadband-ISDN, optical-fibre technologies, personal communications network technologies and multi-media terminals and systems technologies.¹⁶ Jockeying continued throughout the period between ministries and research institutions for research funds, and for the authority to allocate them.

The SSTC took a further step in July 1988 to maintain its initiative when the Torch Plan was announced. The Torch Plan was designed to address the issue of the commercialization of research and development by forming 'clusters' of high-technology industries at the national and provincial levels. By 1996, 110 high-tech industrial zones had been established in China under the Torch Plan involving some 15,000 new enterprises, according to Wang Ruiming, director of the SSTC Torch programme, who also announced the plan to 'buckle' these zones into seven 'belts': Suzhou-Wuxi-Changzhu in Jiangsu province, Pearl River delta zones in Guangdong province, the Shangdong Peninsula, the Liaodong Peninsula, along the Beijing-Tianjin-Tanggu expressway, southeast Fujian province, and Shaanxi-Shanxi provinces (*China Daily*, 11 April 1997). Besides electronics and information, the industries covered include computer-controlled machinery, new materials, biotechnology, new energy sources, and environmental protection.

It is important to register these developments because the legitimacy of the CCP rests heavily upon its ability to develop China, and a pragmatic mixture of planning -- that is, the central direction of resources -- and decentralization through market reform has evolved since 1978, combining industrial policy with a significant shift of emphasis, especially in very recent years, from capital goods industries to consumer goods industries. These developments undermine the role and authority of some parts of the state apparatus and create space for new interests to arise. Inevitably conflicts of interest do arise within the state bureaucracy as a result. If we wish here to rationalize the argument, it would be that these policy shifts are being driven, as elsewhere in the world, by the need to embrace rapidly changing technologies -- especially digital or computer-related technologies -- and since these changes involve varying degrees of convergence across industrial sectors that traditionally came under the authority of different ministries, a restructuring and even a dismantling of the state bureaucracy becomes essential.

Of course, many other factors are at work. For example successful economic development inevitably produces structural and demographic changes that give rise to new industries and new needs. For example, an important restructuring of the economic plan in the mid-1990s now places home-ownership at the centre of policy. This will create a demand for mortgages, a relatively low-risk form of bank lending,¹⁷ will stimulate a labour-intensive urban building programme, and will accelerate the appearance of a middle-class with middle-class consumption patterns.¹⁸ The multiplier effects on China's many local economies can be expected to further stimulate the consumer goods markets and domestic industries such as TV-set and computer manufacturing, and electronic products and devices, including telecommunications equipment. Ministries like the MEI have been following these events since the 1980s, trying to reinvent themselves as their traditional authority roles and their traditional markets disappear.

From the Open Door policy onwards the MEI's fortunes were closely tied to the issue of convergence and how the State Council apportioned ministerial responsibilities. In 1982 the responsibility for policy recommendations to the State Council specific to the computer and semi-conductor industries were handed to a new Leading Group for the Revitalization of the Electronics Industry (originally named Computer and LSI Industry) which by 1984 came under the leadership of then vice-premier Li Peng. In 1985 telecommunications equipment manufacturing was added to its remit. The Leading Group was the liaison point between the State Council, the state commissions and ministries and in particular with the Ministry of Foreign Economic Relations and Trade (Mofert) from which the Leading Group secured privileged access to foreign exchange allocations for the telecommunications sector. Telecommunications equipment, computer manufacturing, semi-conductors and electronics became priority areas in China's industrial policy. The Leading Group's 1985 'Strategy for the Development of China's Electronics and Information Industries' set the guiding themes for the development of the electronics industries for the next decade, including the 'close co-ordination and integration in the development of the electronics, computer and telecommunications industries'.¹⁹

The industrial structures of China created during the 1950s were mostly modelled on those of the Soviet Union, highly vertically integrated and inimical to 'close co-ordination' which requires horizontal and indeed multiple -- in today's networking language 'distributed' -- lines of communications. Communism 'with Chinese characteristics' included Chinese walls between distinct and separated ministerial fiefdoms, a major obstacle to horizontal communications. This inherited problem remains to this day, and typically communication between state organizations involves protocols, with authorizations required to travel up-and-down the various levels within one administration before an appropriate corresponding and equivalent level is found within the other administration. Thus the traditionally vertically integrated ministerial structure of the MEI was an obvious hindrance to the achievement of horizontal collaboration -- 'convergence' -- between research laboratories and the many state enterprises engaged in the different fields of electronics research, development and manufacturing. As a result the MEI underwent a radical restructuring, effectively divesting itself of all but two of the 172 enterprises and 2,600 factories which it directly or indirectly administered alongside over 130 research institutes and six universities.

The paring of the size and influence of the MEI left the ministry adrift until the appointment of Hu Qili as minister after the Tianamen Square tragedy in 1989. Hu Qili was close aide of fallen reformist premier Zhao Ziyang, and his appointment as minister was testimony to his rank within the CCP and his decisive qualities. In Hu Qili the MEI gained an authoritative leader capable of a manoeuvre to outflank the powerful MPT and gain for the MEI an important role in China's nascent electronic information communications and technology sector. In 1993, Hu Qili sold the State Council the idea of the Three

Golden Projects,²⁰ the Golden Bridge (Jin Qiao), the Golden Card (Jin Ka) and the Golden Gate (Jin Guan)²¹ It is important to note that this was not a proposal to compete with the MPT, nor a proposal to denationalize or liberalize the sector, but rather a proposal to reinforce the state's capability to monitor and control the economy by building what, in effect, was a China national information infrastructure, or CNII. It fitted exactly the perceived needs of China's government to source national economic information reliably and speedily and to match the world in information network technology development. The proposal was cleverly targeted. The then Party Chairman Jiang Zemin had championed the idea of an effective and modernized Central Bank system, and this became the Golden Card project. Vice-premier Li Lanqing had already initiated a project to link the networks of the Ministry of Foreign Trade and the Ministry of Custom, and this became the Golden Gate project. The JiTong Corporation was created under MEI auspices to construct the Golden Bridge, which was portrayed as a giant systems integration exercise interconnecting many of the networks already serving different ministries nationwide, and including leasing circuits from the MPT. Just as Unicom was portrayed as 'supplementing' or 'complimenting' the MPT's public network, rather than competing with it, so JiTong was adding to, not competing with, the MPT's national digital data network (DDN) services. The Golden Projects Office, located within the MEI coordinated most of the golden projects that were subsequently created. This Office, along with the MEI, has now been absorbed into the MII.

Evidence of the success of the Golden Projects or CNII initiative was the 1996 upgrading of the original body, the Joint Conference on National Economic Informatization, to the status of Leading Group for the Informatization of the Economy. Evidence of the potential for conflicting interests and the scope for bargaining between ministries and commissions came from the composition of the Leading Group: eighteen different bodies were represented. Vice-premier Zhou Jiahua chaired the meetings, with MPT minister Wu Jichuan and MEI minister Hu Qili as vice-chairs. The other ministries represented at vice-minister level were the Ministry of Radio, Film and Television (MRFT), Finance (MOF) and Foreign Trade and Economic Cooperation (MOFTEC). The PLA was represented, as was the powerful State Planning Commission (SPC – now renamed the State Economic Development Planning Commission, SEDPC), the State Economic and Trade Commission (SETC),²² the State Education Commission (SEC) and the State Science and Technology Commission (SSTC). Others included the People's Bank of China, the Tax Bureau, the State Security Bureau, Customs Bureau, and so forth. It is all the more remarkable therefore that this body, the Leading Group, should have been disbanded and its functions subsumed within the new MII. A bargaining model suggests that this radical reorganization, by eliminating the MPT, MEI and MRFT distinction, is likely to recreate rival fiefdoms within the new MII at central and, even more likely, at provincial levels unless carried through with considerable vigour. It further suggests that other state entities with close interests in the CNII, and possibly even the emerging non-state entities that are springing up to challenge the monopoly of the MPT, will mount their challenge less and less through the state mechanism and more and more through competitive enterprise. In other words, China's policy-making process may be about to go through an interesting change in which the state bureaucracy – and the Party machine which shadows it – plays a diminishing role as mediator of rival administrative and factional interests. This shows the bargaining process shifting toward a different set of commercial criteria.

Ministry of Radio, Film and Television (MRFT)

The MRFT represents the third principal component of the converging triad: telecoms, computing, cable TV. Compared with telephone density, television sets receiving programmes free-to-air or through cable are ubiquitous in China. In the 1960s and 1970s state-manufacturing enterprises built private cable TV systems as fringe benefits for their employees, and in 1980 a State Council resolution approved the

installation of Master Antenna TeleVision (MATV) systems in all new buildings. Rural areas were served by satellite. A policy followed in 1988 to permit local governments to connect up the private systems to the MATV networks with coaxial cable and headends to create 'urban networks'. One such network was permitted per city, but this was in addition to the city network built out by the MRFT. So, in many of China's cities, there are in fact two cable TV networks. Most MATV systems in residential buildings remain unconnected to the urban networks and receive broadcasts by microwave MMDS. The condition is described as an 'estimated 70 million subscribers are served by a chaotic jumble of over 3,000 private service operators'.²³ The drive to integrate these different systems has been motivated by the aim of providing subscription services with programmable set-top boxes and decoders which enable the service provider to cut-off service from non-payers. The design and manufacture of the microelectronics involved is very much part of China's effort to develop its electronics industry.

Perhaps the most compelling early example of convergence is the potential for the delivery of telephony over cable TV networks. The issue is not a technological one so much as a financial one. The MPT and the MRFT never came to a nationwide agreement to promote the possibility of this convergence, and at local levels experience differed widely. For example, in Shanghai, which is a highly concentrated metropolis with a strong municipal government -- in recent years the 'Shanghai faction' has been dominant within the CCP -- the mayor ensured the local PTA and MRFT jointly built out facilities and shared revenues, while in the less rule-bound Guangdong province, which borders Hong Kong, PTAs and cable operators were known to cut each other's wires!

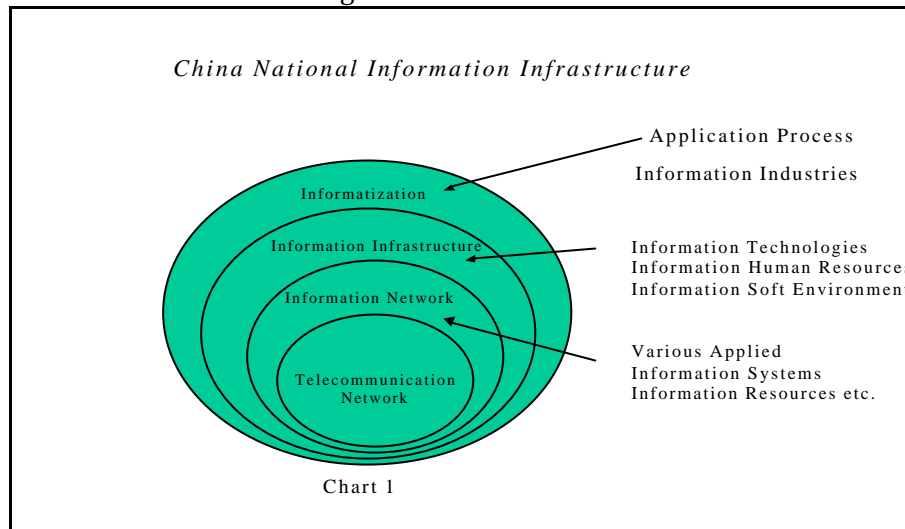
The MPT would clearly gain from any arrangement that requires cable networks to carry telephony. Besides the revenues available, it will strengthen the scope of the MPT's local loop access at a time when alternative telecommunications operators threaten the monopoly. The formation of the MII seems to deliver the MRFT into the MPT's hands. None of the four vice-ministers appointed comes from the MRFT.²⁴ There is, of course, one area in which ideology remains uppermost and that is broadcast content. Content control has not been transferred to the MII, but to a separate Broadcast Bureau which, unusually for a Bureau, reports directly to the State Council. The Bureau will work closely with the Party's Propaganda Department.²⁵

Spectrum and Satellites

The inclusion of the State Radio Regulation Commission (SRRC) in the MII is logical, but again underlines the consolidation of the MPT's influence. The SRRC, like the Leading Group, used to represent a spectrum of interests, most crucially the military. At the time of writing it is unclear whether the military, which holds radio frequencies of its own, will retain any representation on the SRRC. Radio spectrum is a scarce and therefore valuable resource. Previously the SRRC was housed within the MPT's building but with guaranteed autonomy. Until China Telecom becomes truly independent of the MPT, or until the MPT becomes entirely independent of China Telecom, there are likely to be contending influences on the SRRC. The inclusion of the satellite networking administrations of the Aviation Industries of China and the China National Aerospace Industry Corporation in the merger again seems logical. In an era of technological convergence cable and radio as means of service transmission and delivery are complimentary, and service regulation based upon such a distinction is therefore becoming rapidly outdated. The challenge for the future will be less to do with how a service is delivered and more concerned with the regulation and security of content, especially where electronic commerce is involved.

Figure 1 below provides a conceptual overview of the CNII which came to life following the Golden projects proposal.²⁶

Figure 1 China National Information Infrastructure



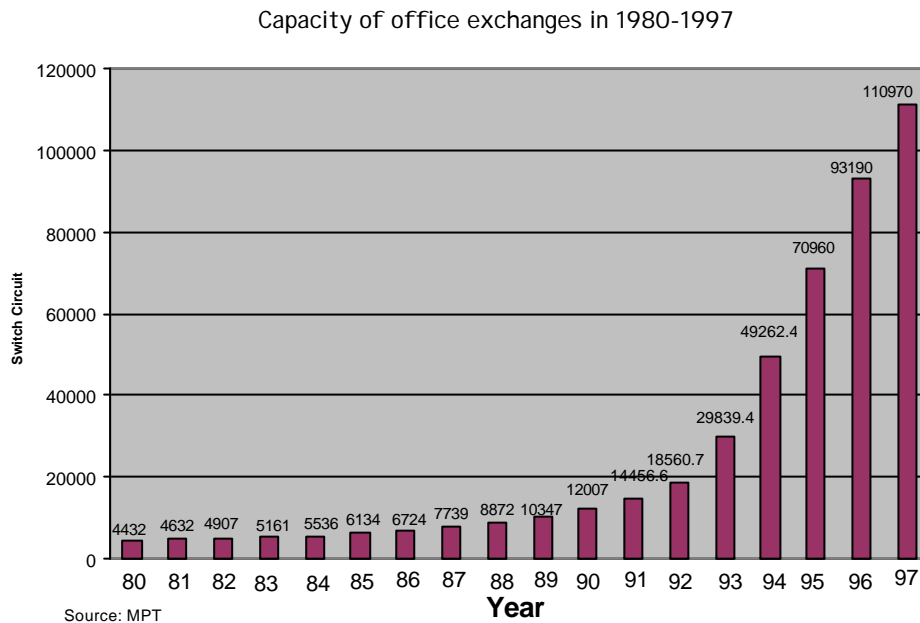
It has four levels. At its centre are the PSTN and PSDN, and around those are the information networks built and operated by other ministries, government departments, state enterprises, and new start-ups using leased circuits. The third level consists of what is broadly termed the information infrastructure itself, the hardware and software which provides content. By 1998 there were, for example, over 1,000 databases online. The fourth level is the use of information as an input into the economic and social life of China, the process of informatization which can raise levels of efficiency, productivity, aid an effective management of the economy, promote the dissemination of information, entertainment, interactive communications and so forth. Levels three and four refer to the applications and their consumption which are popularly termed 'multi-media', but which are probably more helpfully described as 'interactive'.

In China, as in most countries, these applications are in their infancy, and more to the point, China's capacity to generate these applications through developments in microelectronics and through design is also in its early stages. The CNII is therefore to be regarded as a strategic initiative to promote this capacity, to speed up the process of national economic informatization, to provide for the growing home market and to compete in world markets. The CNII has become the contribution of the information age to China's Four Modernizations in industry, agriculture, science and technology, and national defence.

Level One

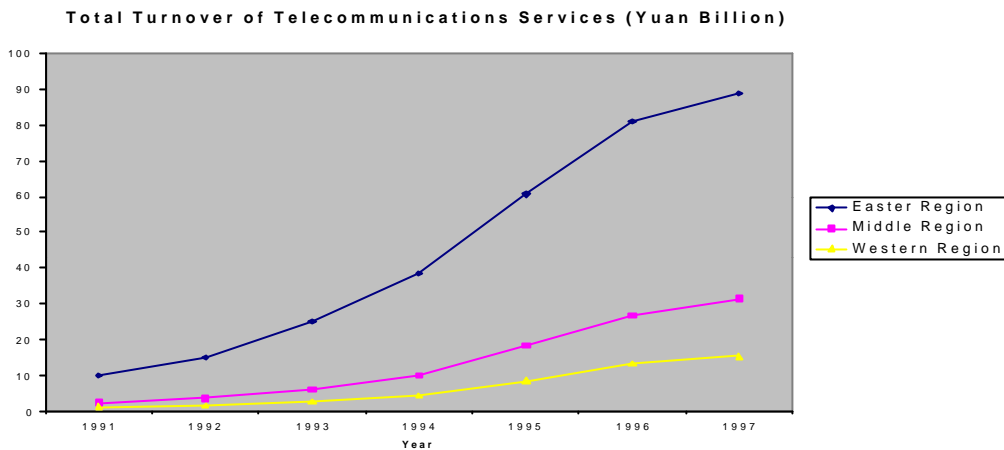
By 2000 China's public telecommunications switching capacity will exceed 180 million circuits, making it the world's largest network. As Figure 2 shows, the growth rate of the PSTN remains in double-digits, with over 20,000 circuits installed during 1996 and a further 18,000 in 1997.

Figure 2 Capacity of office exchanges in 1980-1997



The MPT's 1997 Annual Report forecasts a subscriber base of 112 million for fixed wireline and 38 million for cellular wireless services, and an average teledensity -- the number of subscriber wireline circuits per 100 population -- of 30 for urban areas. In cities such as Beijing, Guangzhou and Shanghai teledensities around 40 or more can be expected. Nationwide teledensity is forecast to reach 10. This highlights the MPT's commitment to tackling the very uneven development between rural and urban areas, and between the eastern and coastal regions where most of the industrial and urban centres are found and the landlocked central and western parts. Figure 3 shows the gradually narrowing gap in the shares of national telecommunications revenues coming from the three regions with the share of the Eastern region falling from 74 per cent to 66 per cent, the Middle region rising from 17 per cent to 23 per cent and the Western regional rising from 8 per cent to 11 per cent.

Figure 3 Total turnover of telecommunications Services (Yuan Billion)



Digital switching in the local loop is now standard for all new installations for cities above the county level and ‘in almost all the urban and rural areas of China.’ (MPT 1997 Annual Report, p.35). But most significant is that 78 per cent of subscribers are now residential -- in 1990 they were less than 30 per cent – and nine out of ten new subscribers are residential. This household penetration of telephone lines has important consequences for the growth of the Internet and future interactive services to the home.

On the long-distance and international side the network is already almost 100 per cent digital in both switching and transmission. A large scale optical fibre cable trunk network with eight longitudinal and eight latitudinal lines crossing China will be completed by 2000. Combined with satellite and digital microwave, this will treble the 1997 long-distance capacity.²⁷ Forty-two per cent of telecom revenues accounted for by China Telecom, the PTAs and rural operators came from domestic long-distance (31 per cent) and international traffic (11 per cent) and around 24 per cent from local traffic, and 27 per cent from cellular services. Data communications and paging services²⁸ contributed around nearly 2 per cent and 5 per cent respectively.

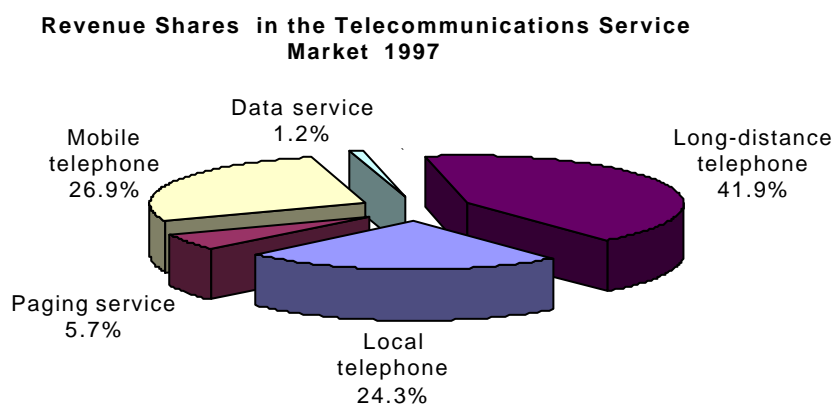


Figure 4 Revenue shares in the telecommunications service market 1997

Cellular subscribers are forecast to top 38 million by 2000 as digital phases out analogue²⁹. By the end of 1997 GSM roaming was available in over 80 per cent of cities at county level and above, and over 90 per cent of prefectural cities, although call completion rates remain a service quality issue.³⁰ On the data communications side, the digital data network (DDN) covered 1,348 cities by

late 1997, with over 140,000 subscribers. The packet switched public data network (PSPDN) likewise provided service to 1,653 cities and townships.

Broadband

Multimedia or inter-active services are planned for nationwide delivery over the existing PSTN using the ATM platform and SDH transmission capacity. The vision beyond 2000 is to build fibre-to-the curb, to the community and to the building in the metropolitan areas -- and 'fibre-to-the-town and fibre-to-the-large-village in rural areas' -- creating a broadband capability.

Although general broadband network development may be premature in China,³¹ some projects have gone ahead. One which seems to have stalled badly involved the Guangzhou Huamei Communications Company, a 50:50 joint-venture between two US companies, SC&M International, a Chicago investment bank, and Brooks Telecommunications, a St. Louis-based builder of advanced telecoms networks, and Galaxy New Technology, a company controlled by COSTIND, the manufacturing, research and development arm of the PLA and the key agency overseeing the upgrade of China's defence industry. The MPT and MEI also hold small stakes in Galaxy. Huamei (which means 'China America' in Mandarin) built a US\$7m prototype, state-of-the-art broadband network in Guangzhou.³² First announced in 1993, the joint venture became partially operational in April 1995 (its official launch was June 15, 1995). The network, which uses ATM switches and the SDH optical transmission standard, was to have carried a range of voice, data and multimedia services to government and business customers in Guangzhou and other cities in China. Other pilot services were to include video-on-demand, tele-medicine and an audio-visual platform for sharing information between hospitals involving Beijing and Shenyang as well as Guangzhou. But as of 1998 no commercial services had been offered.

Level Two

Many non-public networks exist, including wireline, mobile, satellite, trunked radio, and paging. They are built and operated by ministries, such as defence, electric power, railways, transportation (communications), and large state corporations, such as aerospace, banks, and steel works, and joint ventures between local governments and local enterprises. These constitute a substantial second-tier of circuit capacity. Despite the many interconnections which can exist at the local level, circumventing the public/non-public distinction, few of these networks offer scope for nationwide interconnection. But some do, especially those using satellite communications which are widely used for paging services and to a lesser extent data communications. The Golden Bridge Project managed by JiTong is one initiative to construct such a nationwide data communications network. The Financial Data Network, constructed jointly by the MPT and the People's Bank of China, which serves 35 cities across China, is another example of a golden project adding to national capacity.

For voice communications the initiative comes from Unicom which was building GSM networks in 65 cities by the end 1997, 27 of them in operation with over 400,000 subscribers. Unicom was also building paging systems in 44 cities and operating in 22 of them with around 700,000 subscribers, providing VSAT circuits to over 100 users, and was offering local loop wireline service in Tianjin. But just as the MPT was quick to react to Unicom's entry into the cellular market by slashing handset prices and accelerating its own network rollout. The MPT was also careful to anticipate the possibility of Unicom stealing wireline business customers, and therefore began urging enterprises to connect their internal PBXs to the MPT's network. According to the *1997 Annual Report*, more than 3.38 million lines from around 800 organizations had connected through direct-dial-in.

Level Three

With the Provisional Arrangement for the Approval and Regulation of Decentralized Telecommunications Services issued in 1993, the liberalization of China's value-added services markets began officially. Since then the pace of development has been rapid and paging operations have already been well established. The promotion of information databases and information services has been important and it fits well into the government's dual aims of creating a socialist market economy, which relies upon market information and *marketable* information, as well as the means to market services. This also helps reinforce the state's own access to reliable and timely information. As table 1 shows, the growth of value-added services has risen markedly since 1996.

Table 1 The Development of New Value-added Services

	Year				Annual growth (%)
	1994	1995	1996	1997	
Packet switching subscribers	8.5	28	56.4	84.6	115.1
DDN Subscribers	-	17	51.4	111.7	156.3
E-mail Subscribers	2.33	5.93	9.89	14.73	151.4
Videotext subscribers	1.08	2.50	1.99	2.25	27.5
EDI subscribers	-	0.13	0.11	0.22	27.9
Facsimile storage transfer subscribers	-	0.50	1.22	2.91	142.6
Internet Subscribers	-	7	34	159.8	377.8
Frame relay subscribers	-	-	-	3.08	-
N-ISDN subscribers	-	-	-	0.32	-

Unit: thousand

The most spectacular growth in services, as elsewhere in the world, has been in the Internet. Table 1 highlights the dramatic acceleration in Internet subscribers. In China one subscriber account is usually accessed by multiple users, especially when the subscriber is a research institute, government department or enterprise. By the end of 1997 Internet users were estimated to exceed 800,000 and by June 1998, according to the Chinanet Information Center, the number already exceeded 1 million. Packet-switched digital data networks now extend to ninety per cent of large towns and cities, and there are over one hundred registered Internet Service Providers (ISPs) in China providing local access. By regulation those ISPs are required to connect to one of the two national commercial networks, the MPT's ChinaNet or JiTong's ChinaGBN. Two other networks provide nationwide service for institutions of higher education and research, the China Education and Research Net (CERNet) and the China Science & Technology Net (CSTN). As multimedia computers for the home and office become common items in the big cities, the expansion of the Internet will continue exponentially. Estimates place the number of personal computers in use in China at the beginning of 1998 at 8 million, 3 million of which were sold during 1997 alone. MEI estimates suggest 700,000 are home computers, up from 220,000 at the end of 1995. A report in the *China Daily*, 7 March 1998, suggested around 64,000 computers were connected to the Internet, which makes the point that users outnumber subscribers in China by at least 12:1 as accounts are shared.³³ To encourage the growth of this market, during 1997 the MPT was even bundling telephone lines with computer sales.³⁴

Another recognition of this fast developing market was the 1997 Regulatory Measures for China's Public Multimedia Communications which opened the way for market entry by multimedia service providers in quite innovative ways. Due to the MPT's still high leased circuit charges, many ISPs found it difficult to make profits. According to the *South China Morning Business Post*, 12 April 1998, one company, Beijing-based Cenpok, proposed a joint venture with ChinaNet to market a range of multimedia services over the

Internet. The innovation included inviting up to 30 per cent foreign capital in preferential stock, the first such case in China. If the laws of China subsequently permit, this stock could be converted to equity. (But see under 'Investment' below).

Although still in their infancy, the growth of non-MPT service level providers is strong. By the end of 1997 there were nearly 3,000 licensed telecommunications service providers at provincial level, and 99 at inter-provincial level, and the revenues of these 'specialized communications enterprises reached 13.6 billion yuan, an increase of 58.4% over 1996.' (*MPT 1997 Annual Report*, p.52.)

Level Four

Level four is the applications and user level. We have already noted the exponential rise in the number of Internet users. What the MPT loosely terms the public multimedia network is really an intelligent network, using No.7 signalling, capable of providing a raft of information and online services, including audio, visual, video and so forth. To quote the MPT's *1997 Annual Report*,

Data and multimedia communications had become the focus of new social demand and developed quickly. To meet the information needs of the national economy, the posts and telecommunications departments tried their best to provide all types of information services to people in all walks of life. Packet switched service users totaled 85,000, while the digital data communications users 112,000. 160,000 people had become the customers of ChinaNET, and the total number of customers using data services of all types reached 360,000. There were about 800 '168' and '160' information service stations offering rich contents and wide-range services. After interconnection of the public multimedia network in 24 provinces and cities, the total customer number reached 34,000. New services such as 300 Service, 800 Service and N-ISDN were offered to the public. (p.43)

A combination of factors will be driving level four. One will be the MPT's efforts (through the MII) to extend its own markets and revenues. Another will be the liberalization of the services market and the innovations that are likely to follow. Yet another will be the transition to the market economy and the competitive forces which create a demand for information and the need to disseminate it, either as advertising or as product and service. The growth of electronic commerce will be closely associated phenomenon. And yet another will be the continuing growth of the consumer society in China. The IMF and the World Bank have both argued in recent years that the real purchasing power of per capita income in China is between two and five times greater than the official US\$6-700, although China has fiercely challenged this.³⁵ Certainly the more successful China becomes in manufacturing the hardware and the software which will provide the multimedia content, the more relevant will be the purchasing power parity estimate of the scale of China's market for these commodities. Local production of content as well as transmission equipment is an important component of the CNII.

The Planning of the CNII

Following its upgrading in 1996 from the Joint National Conference, the Leading Group for the Informatization of the Economy drafted an outline for the national Five Year Plan and a longer-term plan up to 2010. These were subsequently discussed at the first national working group meeting in Shenzhen, which borders Hong Kong, in April 1997. At the meeting, which was attended by representatives of forty eight different cities and provinces, the MPT, MEI and MRFT were declared to be the three pillars of national informatization. The national informatization was to be applied to agriculture, industry, science, national security and social life. The guidelines announced for the CNII were: centralized planning and direction, unified standards, the coordination of building networks to avoid waste of resources,

interconnecting networks and the sharing of resources. Evidently these principles very much reflect the viewpoint of the MPT and other central planners.³⁶ The following set of principles were also enunciated:

1. CNII development would be market driven, under government control and regulation
2. The functions of government and enterprise management would be clearly separated
3. Chinese sovereignty and security would be protected
4. Military, civilian, public and non-public networks would be coordinated
5. China would strive to become self-reliant on the supply side and stimulate local demand
6. Technological research, development and technology transfer would be promoted
7. The development focus would be on practical applications which fitted local circumstances
8. A framework of laws and regulations was required to ensure proper control and management of the CNII.

Again, the emphasis is very much upon the need for China to develop its capability in the production and supply of information technologies and applications, and keeping to a strictly centralized-view of a rational way in which to use scarce resources to build and interconnect networks and promote the development and use of applications. In China, universities and research institutes are under the direct administration of ministries, including the military, state commissions, the CCP or the state council itself so that the deployment of resources for research and development in networking technologies, computer and data processing and communications is determined for the most part by state priorities. Exceptions, which are growing, are found in foreign-funded research centres, especially in joint-venture and wholly-owned foreign enterprises, and among the start-up companies being pioneered by young entrepreneurs, often university graduates and graduates returning from overseas.³⁷

The Leading Group also proposed stages for the development of the CNII. Stage one up to year 2000, stage two to the year 2010, and stage three beyond. The immediate tasks to 2000 included: the overall plan for the CNII, development of public information through databases, integrate and standardize data traffic systems, widen access to the CNII, move to digital broadcasting, develop regional information systems, build electronic informatization as a 'pillar' industry, develop education about informatization, and establish efficient administrative and management systems. The tasks of stage two included: an increase in applications, a widespread use of business and personal computing, double the year 2000 output of the electronic informatization industry, extend the capacity to innovate with information technology, build a broadband CNII.

Investment

An important feature of China's build-out of the information infrastructure is the degree to which it has avoided dependency upon foreign direct investment. For example, around 80 per cent of investment in the telecommunications infrastructure has come directly from revenue sources, of which 35 per cent has come from installation or connection charges and 40 per cent from usage charges. Soft loans from multilateral agencies, foreign governments and international companies, and leaseback arrangements involving China state enterprises, have also contributed. Overall, foreign investment has accounted for no more than 15 per cent of capital expenditure, although the MPT did forecast this rising to 20 per cent by 2000. The revenue growth of the MPT during the 1990s given in Table 2 illustrates why this has been so.

Table 2
MPT Revenues

Year	Telecom Turnover (US\$)
1992	\$2.6 billion
1993	\$4.3 billion
1994	\$7 billion
1995	\$11 billion
1996	\$15 billion
1997	\$19 billion
2000	\$34 billion ¹

¹ estimate Source: MPT Annual Reports

Access to finance is crucial for new entrants into China's information services markets. Unicom has pioneered the China-China-Foreign (FCC) or *zhong-zhong-wai* model whereby a foreign company partners with a China company, usually in a joint venture which, in return for investment, equipment and telecoms management expertise receives a revenue share from the network's operations which are run entirely by Unicom. The arrangement is designed to avoid China's strict ban on foreign companies having any equity ownership or operational control over networks and network services. This arrangement came under fire from the MII shortly after a report from the State Planning Commission, the State Economic and Trade Commission and the Ministry of Finance (document 405) raised concerns that foreign companies were getting too close to network operations through this back door method. It reaffirmed that foreign investors shall not be allowed 'to participate in the design, construction, operation and management of telecommunications networks.'³⁸ State Council document 98 was subsequently issued, with instructions to the MII to investigate existing Unicom contracts.³⁹

The issue of document 405 raised question marks over the prospects of foreign investment opportunities in China's burgeoning information infrastructure and services sectors, and questions over experiments with schemes for turning non-equity funding into equity-funding at some point in the future, such as the Cenpok proposal discussed above. Restrictions on foreign entry into the film and television industry have been even more severe as these media are considered especially sensitive areas. Some foreign broadcasts, for example CNN, are permitted through satellite downlinking, mostly to hotels and large business establishments, while selective foreign TV programming and films are shown over China's free-to-air and cable networks and cinemas. In China's computer electronics industry entry through foreign joint ventures is more acceptable because it brings a certain level of technology transfer with it, but participation in China's online information services sector is basically governed by the same restrictions imposed upon telecommunications. The converging of these sectors under the control of the MPT-dominated MII at first sight seems to consolidate these restrictive policies.

But one interesting recent development has been the entry of the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) into the information services sector. The first electronic commerce web site of the China Commodity Trading Center (CCTC) has been established under its auspices at www.moftec.gov.cn and includes the China Electronic Commerce Center. Ostensibly this poses no rivalry for the MII, indeed traffic generated by the site will travel over China Telecom's ChinaNet, but it does signal the entry of a new interested party.

Conclusion

Convergence in China, as elsewhere, is recognized to be an issue involving technology standards for interoperability of networks. The standards are crucial for the construction of a nationwide information infrastructure and its applications and for the successful commercial development of the country's own information technology manufacturing industries. Industrial policy and social policy are seen as complementary elements in the role the CNII will play in China's Four Modernizations. The emphasis placed by the Chinese State on the unifying role of the CNII at first sight contrasts with the emphasis placed upon the primary role of the private-sector in many other economies. But, a careful examination of the early 'Information SuperHighway' rhetoric of the Clinton-Gore Administration⁴⁰ will draw many parallel concerns with the need to promote national industrial and economic interests. What is particular in the case of China is not the concern with 'national interest' but the bargaining process within which the CNII is emerging.

On the face of it, the creation of the MII consolidates the influence of the MPT (telecoms) old-guard over the rival claims of the MEI (computers) and the MRFTV (cable) and *imposes* a policy synergy, or convergence of interests, upon different elements within the state bureaucracy that were previously engaged in the bargaining process. In practice what this may mean is a shift in the locus of the bargaining process and a reconfiguration of the contending interests. One of the MII's tasks is to foster the creation of large – that is, economically viable – industrial conglomerates capable of funding research and development in the more advanced ends of micro-electronics. That process, known as corporatization in the West, is the industrial policy part of the socialist market economy. On the networking side, the same thing is happening. China Telecom, China Unicom, China Great Wall, the Jitong Corporation and others are the emerging corporate players. Each has its own commercial interests and the logic of the market will act as a centrifugal force. As this happens and each corporate entity learns to manage its markets, the issues of technological convergence will become secondary to the issues of business synergies. The joint provision of services – multi- or new media -- will be determined less by the technological capabilities of service delivery systems and more by the commercial advantages of marketing such services. This process is fuelled by the shift of China's central economic policy strategic from capital to consumer goods production – including associated capital goods such as micro-electronics – which is already creating a mass consumer market in China. The explosive growth in the demand for cellphones and home computers are poignant examples.

There are clear weakness in the structure of China's economy, and managing through the transition will involve several decades of industrial modernization, including coming to terms with 'post-modern' concerns such as heterogeneous social development of cultures, lifestyles and preferences. From the viewpoint of the State in China, and the MII, the real challenge is steering regulatory reforms in this direction without weakening its bargaining position with the world's leading multinational IT companies. At root that bargaining position is to demand a commitment to technology transfer into China. The multinationals will be hoping for a growing convergence of interests between themselves and China enterprise partners, especially where research and development, intellectual property rights, licensing and franchising issues are involved. This will add considerably to the complexity of the bargaining model and its further development will demand careful study.

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¹ Professor Liang Xiong-Jian is director of the Department of Management Engineering, Beijing University of Posts & Telecommunications. Dr John Ure is director of the Telecommunications Research Project, University of Hong Kong. (www.trp.hku.hk)

² The MII minister is from the MPT, three of the five vice-ministers are from the MPT, none are from the MRFTV, and of the two from the MEI one moved out of the MII within two months.

³ The bargaining model implied here is articulated and researched in depth by Peter Lovelock in his Ph.D thesis *The Evolution of China's NII Initiative: A Policy Making Analysis*, Department of Political Science, University of Hong Kong (presented 1998) and is summarized very briefly by John Ure, October 1997, 'China's Telecommunications - A Bargaining Model' at www.trp.hku.hk.

⁴ On the policy side the State Radio Regulation Commission (SRRC) was absorbed. On the industry side, the satellite administrations of the China National Aerospace Industry Corporation and Aviation Industries of China were included.

⁵ This is certainly not the first time since China's Open Door policy in 1978 that efforts to trim the state bureaucracy have taken place. As on previous occasions the mixture of motives included an effort to accelerate market reform and decentralize financial responsibilities and decision-making; also a need to balance contending interests within the bureaucracy; and a requirement to reduce the state budget. The financial turmoil which hit Asian economies from the summer 1997 was a backdrop and an additional inducement to reform the state's allocation of resources on a more selective basis and with a greater ability to monitor the effective use of those resources.

⁶ There was public uncertainty up to the last moment as to who would emerge as the minister of the new MII. In the event Wu Jichuan was chosen, the minister of the MPT.

⁷ Municipal governments in rapidly growing cities like Chengdu, Dalian, Guangzhou, Shanghai, Tianjin are competing with each other for domestic and foreign investments, and being able to boast a good telecommunications infrastructure is important. Shanghai, for example, is heavily promoting its Information Infoport as a means to attract overseas corporate investors who rely upon good communications.

⁸ At one time all foreign equipment suppliers had to report first to Beijing and would be allocated a province. Today overseas equipment suppliers have their own close working relationships with PTAs and local governments, although cautious companies maintain close liaison with Beijing as well. One well-developed PTA expressed views to one of the authors that they resented being directed by the MPT to buy equipment from a local switch manufacturer, and would in future insist upon their right to buy independently.

⁹ Below the county level are thousands of Township and Village Enterprises (TVEs) which run independent rural networks, which interconnect with the PSTN at the nearest point. For example, these may interconnect first with the railway network until the circuits reach a nearby county town.

¹⁰ MPT statistics show that by 1997 China Unicom's share of the national mobile market was around 2.6 per cent. Its highest penetration was in Chongqing where it had captured over 12 per cent.

¹¹ Despite efforts to reduce the size of the PLA, the world's largest standing army, it remains a huge organization in desperate need of funds to house, feed and clothe itself in addition to modernizing its armoury. The PLA has therefore developed a formidable business structure all of its own. Ownership of radio spectrum covering military frequencies nationwide is an asset, a scarce resource, of tremendous commercial potential, and in 1993 (Order 128 of the State Council and Central Military Command) the PLA was granted the right to use frequency it could free-up from military purposes to commercial advantage. Many of the non-public (non-MPT) paging operations across China, for example, are joint ventures between equipment suppliers – some from Hong Kong – and PLA business units using PLA-controlled frequencies. Many trunked-radio networks also involve PLA business units, as do some non-public cellular systems. (The expression 'non-public' is used here because in China there is as yet no recognized property right in this area designated as 'private').

¹² Although by mid-1998 the Great Wall Pilot Network had rolled out narrowband CDMA in four cities, the decision to deploy it nationwide was in suspension pending the development of a broadband CDMA standard.

¹³ The authors are grateful to Peter Lovelock, Ph.D candidate at the University of Hong Kong, for many of the insights that follow and which are elaborated in far more detail in his thesis.

¹⁴ For example, the Centre for Information Infrastructure and Economic Development (CIIED) was established within CASS with support from the Centre for Strategic International Studies (CSIS) in Washington, D.C.

¹⁵ See Saiman Hui and Hilary B. McKown 'China Computes', *The China Business Review*, September-October 1993, pp.14-24.

¹⁶ An associated initiative was the 'Spark Programme' to promote high technology applications and their spread to the rural areas. Reforms in agriculture and the encouragement of rural entrepreneurs have been supported by the promotion of process technologies, training and information databases. By 1996 nearly 130 'spark technology zones' existed and 217 regional economic 'pillar' industries had been promoted

¹⁷ The importance of providing China's banking system with a new raft of low-risk loan opportunities should not be under-estimated. China is only too well aware of the need for banking sector reform, and among other things this includes a technological modernization. Banking is usually a driver in the use of telecoms and IT but until recently in China this has not been the case. The Golden Card and Golden Finance projects, which aim to spread the use of debit bank cards and introduce a nationwide electronic bank clearing system, are examples of the top-down approach to modernization which has ran into a series of local-level difficulties as different banks had their own views as to ownership of the new systems, and as to which of the systems and competing world standards to adopt. A bargaining model approach suggests that as China devolves towards a 'socialist market economy' a powerful political economy emerges at each level of the society which mediates all national planning initiatives however rational, comprehensive and unified they at first appear.

¹⁸ Shanghai, for example, actually advertises 'blue-card' work-permits for citizens from outside who buy property in the Pudong development area as a way to stimulate the local property market and attract a stratum of China's new middle class.

¹⁹ Dennis Simon 'From Hot to Cold' *China Business Review*, Nov-Dec. 1996, pp.1-16

²⁰ This account is based upon interview information from the Office of the Leading Group on Informatization, 13 May 1997, given to Peter Lovelock, Ph.D candidate, University of Hong Kong.

²¹ These were, respectively, a national bank debit card project, a national medium-speed data network based largely upon satellite links, and a national EDI system for customs declarations and clearances. The adjective 'golden' is regularly used in China to denote a project of special importance, which has state backing. By 1998 there were upwards of twenty such 'golden projects'.

²² The SETC held formal authority over, and appointed the top management of, China Unicom, the creature of the MEI, which was a joint venture with the principle shareholders, the Ministry of Railways (MOR) and the Ministry of Electric Power (MEP) until the creation of the MII.

²³ 'A Thin Ray of Hope: The MII and its Impact on China's Telecoms Markets' *China Focus*, Pyramid Research, Cambridge, UK, June 1998, p.6.

²⁴ MEI representation is also weak. Initially six vice-minister positions were announced, including Liu Jianfeng the former MEI vice-minister. But Mr Liu was subsequently moved to head up the Civil Aviation Administration of China.

²⁵ In separating content from transmission issues China is following global trends in regulation, an example of 'regulation with Chinese characteristics'.

²⁶ In the same year Hu Qili presented the Golden Projects proposal to the State Council, the commission appointed in the USA by vice-president Al Gore reported back on the recommendation to build America's information superhighway. *The National Information Infrastructure: Agenda for Action*, Executive Office of the President, Washington D.C., 1993.

²⁷ 200,000 kilometers of optical cable will be supplemented with 140,000 kilometers of digital microwave and 40 large satellite earth stations

²⁸ China has around 35 million pager users. Twenty-two provincial capitals and municipalities were interconnected to the nationwide 280 MHz high speed paging network and the '126' and '127' and '198' and '199' networks. The MPT has been actively buying up, or in some cases closing down, hundreds of small 'private' paging operations in an effort to control the use of frequencies, sometimes for reasons of safety to prevent interference with aircraft radio systems.

²⁹ In 1997, 6.8 million of the 13.2 million cellular phones in use were digital.

³⁰ The call completion rate for cellular was just 45.5 per cent according to the *1997 Annual Report*. Call completion rates for local, toll and international telephony varied between 40 and 60 per cent.

³¹ The network architecture of broadband differs from the fully meshed multi-exchange configuration of the narrowband digital network. The former requires fewer, high capacity switching nodes and optical fibre cable loops interconnecting with fibre local loops. The expense of multi-exchanges is replaced by the expense of subscriber line-equipment which identifies and separates multiple traffic streams - and the expense of server capacity to feed through multi-media services inter-actively. In anticipation, China's long-distance PSTN architecture is shifting from four-levels of switching, including town and county, to a two-level switching network.

³² The story behind the equipment Huamei uses is of some historic significance. Until a couple of years ago, China was one of several so-called 'non-market' countries that were banned from importing high technology that could have military applications (the COCOM restrictions). One of the principal reasons for SC&M International's involvement in the joint venture was its president, Adlai E. Stevenson, a former senator in the US Congress (1971-81) and chairman of the sub-committee which oversaw the law which governed the export of high technology (the Export Administration Act). Mr Stevenson understood better than most how anachronistic the

COCOM restrictions had become by the 1990s. By doing the rounds in Washington to seek approval for the export of the ATM switches and SDH fibre optics, he contributed to the dismantling of COCOM.

³³ Other sources put the figure much higher. The data quoted is from a variety of sources, from the MEI and MPT, from issues of *China Daily*, *China Telecommunications Construction* and *CTC News*.

³⁴ The MPT is motivated by a desire to control Internet telephony as a threat to its traditional revenue base, and to take advantage of new media revenues that may emerge downstream, that is at the consumer end, such as web-based video services or electronic commerce. This is straightforward, but so frequently mis-interpreted. For example, in early 1996, the *Asian Wall Street Journal* (January 22) and *Time* (January 29: 15) (among others) were able to assert that a moratorium on new Internet subscribers and a requirement for financial information providers, such as Reuters, to work through Xinhua (China's official news agency) represented an end to China's experiment with public access to the information superhighway and an end to real-time information access. But as the Economist Intelligence Unit's *Business China* (February 5 1996: 1-3) noted, the case with the Internet was "pretty straightforward. Suppliers of Internet accounts have been ordered to halt sales because capacity is jammed as many as 70,000 people are trying to access the Internet through 7,000 accounts only half a year after public access became available." Meanwhile, Xinhua executives were hoping to follow the examples of the Indonesian press agency Antara and the Malaysian press agency Bernama and demand a cut of revenues from financial information providers -- another example of the bargaining process in China telecommunications sector. Of course, China, like many other countries, wants to control the content of information for as long as they can do it. In China censorship is done by the public security bureau identifying unacceptable Web sites and sending blacklists of them to service providers. If mirror sites are set up they have to hunt for them also. It must be a very labour-intensive task.

³⁵ The issue is politically sensitive because the higher figure could cut China off from developing country conditional loans. Purchasing power parity estimates are only significant to consumption where the goods or services are domestically produced, but this will become increasingly true in China's information technology capital and product markets. For example, in China's cellphone market which has been entirely dominated by Western companies, local companies such as Huawei Technologies, Datang Telephone Corporation and Golden Dragon Telecommunications, are now estimated to account for around 6 per cent of the value of infrastructure sales, including cellular switches and base stations. ('Comeback Kid' *Far Easter Economic Review*, 3 September 1998, pp.10-14)

³⁶ These principles follow closely the document 'Suggestion of the Central Committee of the Communist Party of China on the making of China's Ninth Year Plan for National Economic and Social Development and the Long Range Objectives to the Year 2010 (28 September, 1995),' which states that 'it is necessary to make the most of the capabilities of the public communication networks and the special purpose communication networks, to continue to construct communication trunk lines, especially optical cable trunk lines, so as to form an integrated communication system'.

³⁷ There are around 170,000 Ph.D students from China studying in the USA according to the Chen Zhangliang, vice-president of Beida University, speaking at an Institute of the Future conference in Hong Kong, 18 - 21 May, 1998. He also mentioned that China aims to raise R&D spend from 0.55 per cent to 1.5 per cent of GDP by 2000.

³⁸ Ji Jiao Neng (18 March, 1998) No.405 General Office of the State Planning Commission, Beijing.

³⁹ *Asia-Pacific Telecoms Analyst*, 14 September 1998 (Financial Times Media & Telecoms) p.1. According to the Financial Times, 30 October 1998, Minister Wu 'said the main violation was that foreign partners have often derived revenue from installation fees. Such fees should be used to pay for infrastructure construction, especially in the more marginal areas of China.'

⁴⁰ For an excellent review of the NII agenda in the USA see Donald Altschiller ed. *The Information Revolution*, The Reference Shelf v.67.5, H.W.Wilson, New York, 1995.