
The evolution of China's mobile telecommunications industry: past, present and future

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Abstract: This paper studies the evolutionary direction of the mobile telecommunications industry in China. Different stages of the industry development process with policy intervention and market competition are examined. The interaction of different players like the Chinese government, incumbent operator, and competitive operator within an actor-network is studied. A process-mapping technique is used to visualise the key drivers of the evolution trajectory of this giant industry. In the meantime, an analytic framework is developed. The future road toward 3G network in China is also analysed.

Keywords: evolution; mobile telecommunications; China.

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1 Introduction

In July 2001, the Ministry of Information Industry (MII) of the People's Republic of China announced that the number of its mobile phone users has reached 120.6 million, which makes China the largest mobile communication market in the world. Compared with other developed countries, this is indeed a significant milestone for China's mobile telecommunications industry after 14 years of government-led development without

privatisation. This industry has achieved a sustained development over the past few years despite the sluggish development of the global telecommunications market. The number of mobile subscribers in China had doubled each year from 1994 to 2001. By the end of 2002 China had 206.3 million mobile telecommunications subscribers (MPT, MII, 1994–2002), and had become one of the hottest spots for the international and domestic telecom operators, equipment and phone manufacturers. The evolution of China's mobile telecom industry since its inception in 1987 appears to be a multistage industrial development process with policy intervention and market competition. This research traces the periods of the evolutionary process to capture the patterns and drivers in such a process.

There is extensive literature on the relationship between industrial structure, entry and the diffusion of technology in the telecommunications industry. In the mobile telecommunications circles, systemic innovation examples are the successive generations of first generation (1G), second generation (2G) and third generation (3G) systems. The revolution will impact not only our daily lives and the way business is conducted (Siau and Shen, 2003; Maitland et al., 2002; Barnes and Corbitt, 2003). The time span of developing a new cellular system was longer than ten years, and demanded access to vast amount of resources. Thus, a mandate to develop such a system from policy makers including the government, or corporate boards was needed (Hughes, 1987; Lyytinen and Damsgaard, 2001; Haug, 2002). Some studies have considered individual or a limited number of countries, focusing on mobile telecommunications market conduct (Parker and Röller, 1997); on the role of country characteristics (Dekimpe et al., 1998); or on the new service adoption and diffusion behaviour (Anil et al., 2003; Gruber and Verboven, 2001). Other studies paid more attentions to the technology trajectory aspect (Helo, 2003). Gruber and Verboven (1999) looked at the effects of competition on diffusion in European countries, emphasising the importance of capacity increase due to the transition from analogue to digital technologies.

However, previous literature in mobile telecommunications cycle falls short in exploring the roles of policy design and market competition in large developing countries' industry development without privatisation. This paper aims to map out the structure and dynamics of the Chinese mobile telecommunications service industry within the actor-network perspective. Actor-network can be used to examine the processes including the interactions, connections and activities of the actors (Comber, 2003). There are a large number of enterprises and bureaucracies contending for economic advantage and power within China's domestic mobile telecommunications sector with different involvement in the industry development. For analytical purposes, it is useful to first reduce these entities into three distinct actor groups: the regulator, the incumbent operator and the competitive operator.

We have conducted an empirical study on China's mobile telecommunications industry. Interviews were conducted with key managers from the two existing mobile operators and some government regulatory officials. Secondary data was collected from government statistics, industry report, and other corporate reports. The data collected over a period of time in the course of the industry's development will be used for in-depth analysis. Mintzberg and Waters (1985) proposed the use of a mapping technique to identify patterns and interactions among multiple interrelated variables. The interactions among different actors in China's mobile telecommunications industry and the linkages of their activities are mapped according to Mintzberg's technique.

The paper is structured into six sections. The evolution of mobile telecommunications is discussed in Section 2. The regulatory environment of China is reviewed in Section 3. Section 4 shows the evolution-process mapping after which an analytical framework is developed to facilitate the understanding of the evolution. The future road to 3G of China is discussed in Section 5. Finally, the implications of this research for government policy makers and industrialists are discussed.

2 The evolution of mobile telecommunications in China

The evolution of Chinese mobile telecommunications industry from the end of the 1980s could be chronologically divided into four periods, namely the pure monopoly, competitive, pure duopoly and pre-3G periods (see Table 1).

Table 1 Evolution periods of China's mobile telecommunications industry

	<i>Pure monopoly period</i>	<i>Competitive period</i>	<i>Pure duopoly period</i>	<i>Pre-3G period</i>
Time span	November 1987–July 1994	July 1994–April 1998	April 1998–May 2002	May 2002–2005
Mobile systems	TACS, AMPS	GSM, TACS	GSM, CDMA IS-9 TACS	GSM, (GPRS), CDMA IS-95A, (CDMA2000-1X)
Major players	China Telecom	China Telecom, China Unicom	China Mobile, China Unicom	China Mobile, China Unicom
Regulator	MPT	MPT	MII	MII
Subscriber Number reached (in millions)	1.1	16.8	175.2	300

Source: MPT, MII

2.1 *Pure monopoly period*

The poorly developed landline telecommunications infrastructure in China has become a bottleneck for domestic economic growth in the past and the same story applies to the first stages in the development of mobile telecommunications. The TACS (Total Access Communication System), the first analogue cellular system was provided monopolistically by China Telecom in Guangzhou, the biggest city in Southern China. This first cellular exchange opened with a subscriber base of 150 in November 1987. The AMPS (Advanced Mobile Phone System) was introduced in Northwestern China also by China Telecom. The heavy and clumsy analogue handset soon became a symbol of wealth and status in big cities due to high handset prices and service charges. In 1992, in order to purchase a handset from China Telecom (there was no other choice) and get connected, users incurred costs amounting to US\$4,300, which was equivalent to 14 times the GDP per capita in the same year (NBSC, 1992). Only local businessmen and foreign corporations were able to afford such mobile services.

Before 1998, China Telecom and the regulator of telecommunications industry in China were affiliated. China Telecom was once the only state-owned operator to monopolise the telecom market before the founding of its first competitor in 1994. As a regulator, the MPT (Ministry of Posts and Telecommunications) was also responsible for the operational and financial performance of China Telecom. In this respect, China Telecom and the MPT shared common interests (Xu, 2001). As a result, the competition in the mobile telecommunications market was impeded and therefore the welfare of the consumers could not be guaranteed. In 1993 when the Chinese government decided to establish a new competitor, there were only less than 700,000 mobile phone subscribers in China, the most populous country.

2.2 Competitive period

Facing the global trend towards liberation and great pressures from home and abroad to break down the monopoly, the Chinese government was inclined to use domestic competitors to pressure the mobile telecommunications sector to be more efficient. In July 1994, limited competition in the wireless sector was finally introduced with the entry of China United Telecommunications Corporation (China Unicom), which is a joint venture between shareholders from the Ministry of Electronic Industry (MEI), the Ministry of Railways (MOR), and the Ministry of Electrical Power (MEP). The foundation of China Unicom formally indicated a fundamental paradigm shift in the evolution of the industry and terminated the historical monopoly operation of the mobile telecommunications network in China.

China Unicom soon decided to launch the advanced digital mobile service to challenge the operation of analogue network by the China Telecom. On 17 July 1995, a year after its establishment, China Unicom commercially launched its GSM (Global System for Mobile Communications) services in Beijing, Shanghai, Tianjin and Guangzhou. Nearly the same time, the China Telecom also began to launch its GSM service, providing automatic roaming service to 15 provinces and cities in January 1996. The analogue mobile subscribers of China Telecom reached 6.85 million in 1997 and then declined sharply. In the end of 2001, the analogue system was finally closed in China.

With the introduction of digital technology, increasing network capacities also stimulated the competition between China Telecom and China Unicom. Both of the two mobile operators have been attracting customers by cutting their service prices. Customers have benefited from reduced handset prices and installation fees, shortened waiting lists and improved quality of service. Take the price of handset, for example, the average price of an analogue handset was \$3,300 in 1995, but the price of a digital handset in 1997 dropped down to \$900 (People's Daily, 1997).

However, the MPT still enjoyed dual status as both regulator and operator. This ineffective regulatory framework put China Unicom at a competitive disadvantage, especially with respect to network interconnection (Xu, 2001). The service provision approval procedure by MPT restrained the network coverage. The number of its subscribers reached only 1.42 million in 1998. In the same year, China Unicom's revenue was only 1/112 of China Telecom's (MII, 1999). China Unicom and its shareholding ministries made strong appeals for the restructuring of the regulatory institution asking for a complete functional and organisational separation between China Telecom and the regulator.

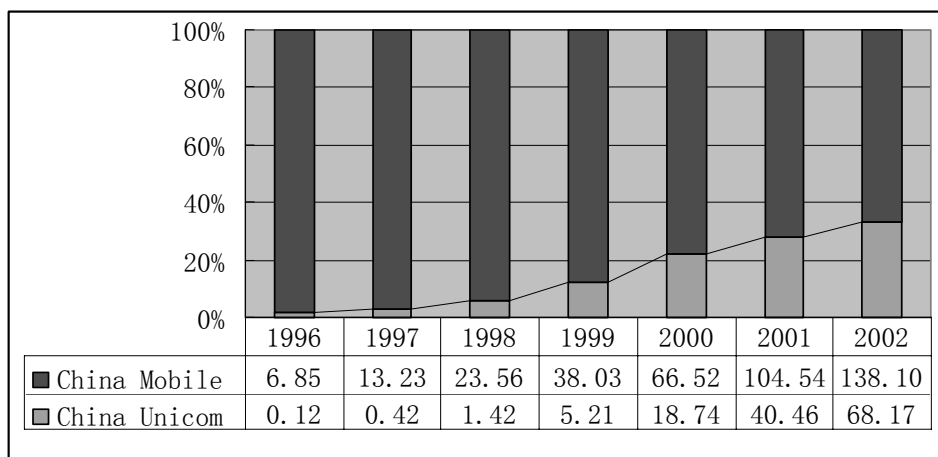
2.3 Pure duopoly period

In April 1998, the MII (Ministry of Information Industry) was formally established by the State Council. Now MII enjoyed a relatively neutral and independent status enabling it to take a more pro-competitive stance thus enforcing competition. As a result, China Mobile was separated from China Telecom and specifically dedicated to mobile services in mid-1999.

Moreover, the attitude of the new regulator toward China Unicom also constituted a sharp change. Instead of limiting its development, MII made a priority policy of facilitating the rapid growth of China Unicom. For instance, in 1999 MII initiated and completed a merger between China Unicom and GuoXin, a national radio paging company with total assets of RMB13 billion (US\$1.6 billion). China Unicom could use its master license to provide GSM network services in any area unlike before where they had to secure special permission to serve each individual area. Furthermore, China Unicom had the right to a price float rate of 10% while the incumbent should obey the fixed tariff stipulated by the regulator.

As a result of this fundamental change in regulatory environment, China Unicom achieved rapid network expansion. With its aggressive marketing strategy, it has developed by leaps and bounds not only in network size but also in the number of subscribers since 1998. Its market share jumped from less than 6% in 1998 to more than 33% in 2002 (see Figure 1). A highly competitive telecommunications market has really emerged in China. The competition has been a strong catalyst for the development in volume of mobile communications market, especially when China Mobile and China Unicom launched the prepaid service without installation fee at the end of 1999.

Figure 1 Growth of China Unicom's market share from 1996–2002



Number of mobile subscribers (000,000)

Source: MPT, MII

On the other hand, the installation fees of contracted mobile subscribers declined from \$360–\$610 in 1993 to \$60–\$70 in 1999 and was finally cancelled in June 2001 (People's Daily, 2001). Table 2 shows the exponential growth of mobile subscribers in China since China Unicom entered the market. In July 2001, MII announced that its mobile phone

users reached 120.6 million, which makes China the largest mobile-communication-user market in the world.

Table 2 Growth of mobile subscribers in China

	1992	1994	1996	1998	2000	2002
Mobile subscribers ('000)	177	1,568	6,853	23,863	85,260	206,270
Mobile service penetration (%)	0.015	0.13	0.55	1.90	6.67	16.19
Percentage of digital subscribers (%)	0	0	24.05	72.31	96.20	100.00

Source: MPT, MII

According to the decision of the State Council, MII granted a license for CDMA (Code Division Multiple Access) exclusively to China Unicom in 1999. China Unicom signed a CDMA Intellectual Property Agreement with Qualcomm Inc. in February 2000 and finally launched its CDMA IS-95A network in January 2002. By that time, China Unicom has become the only venture which runs both GSM and CDMA networks in the world. Despite the challenges of running two companies and keeping two sets of engineering, marketing and sales force, the statistic figures from China Unicom indicated that by the end of 2002, it had recruited some 61.2 million GSM subscribers and over 7.0 million CDMA IS-95A subscribers (MPT, MII, 1994–2002). Its CDMA IS-95A network tended to provide additional wireless data service, targeting medium and high-end subscribers, while the GSM network was concentrating on low-end subscribers who only favoured voice transmission services.

To fully explore the potential of the network resources and to generate more revenues from current subscribers, both China Mobile and China Unicom have introduced a variety of value-added services in the past years. These services include caller number display, voice mail, short messages, call forwarding, call waiting, third party call and VoIP long distance call.

At the end of 2002, the sum of subscribers of China Mobile and China Unicom remarkably reached 206.3 million; the annual revenue of these two mobile operators also reached US\$24.5 billion in the same year (MPT, MII, 1994–2002).

We can see that the decision to introduce GSM and CDMA IS-95A standards in China, in turn, anchored a period of incremental but quick progress. The mobile telecommunications penetration rate in China grew from 0.05% in 1993 to 16.16% in 2002 (MII, 2002). To further explore the mobile data market and make up for their sharply declining ARPU (Average Revenue per User) indicator, China Mobile and China Unicom formally launched their nation-wide WAP (Wireless Application Protocol) service in May 2000. In November 2000, China Mobile introduced the Monternet programme, which combines the platform for mobile and internet. Under this programme, mobile data service providers can access the mobile network anywhere in the country to provide nation-wide service. Such services including messaging, phone payment, mobile QQ, mobile securities, mobile location and broadband services. China Mobile will keep 9% of the traffic revenues while the information service providers receive 91% of the revenue. In the last quarter of 2000, China Mobile set up a subsidiary with HP Corp. to support the Monternet programme. In the meantime, China Unicom also began to provide mobile data service to fuel the growth of its service revenue. To explore the mobile data market, China Unicom formed a joint venture with Qualcomm

Inc. in February 2003 to boost the development of its CDMA wireless data applications through BREW (Binary Runtime Environment for Wireless) platform.

2.4 Pre-3G period

Facing the emerging tide of 3G in the world, China Mobile began to aggressively upgrade its GSM network system facilities to GPRS networks. In May 2002, China Mobile commercially launched its GPRS service in main cities of China. To respond to the technological challenge posed by China Mobile, China Unicom began upgrading the CDMA-IS95A network to CDMA2000-1X network. And the CDMA2000-1X service was first introduced in Shanghai in January 2003. China Unicom also plans to launch a dual-mode handset that is capable of supporting both the GSM and CDMA systems under a new brand in 2004 (China Daily, 2004b).

Since many applications of the 3G can be made available via GPRS and CDMA2000-1X networks, the lessons learned from these transitional networks would be beneficial not only to two mobile operators but also to value-added service providers, and will impact a long-term 3G development in China. Therefore, the regulator and two existing mobile operators seem to be doing an intensive and careful studies on the synchronisation between future technologies and the market before making a decision (China Daily, 2003).

3 Regulatory environment

In China, the basic authority for regulating the telecommunications industry now belongs to MII; besides MII are the State Council and the State Planning and Development Commission (SPDC). Regulatory policies must win support from SPDC and approval from the State Council. As mentioned before, the regulatory environment in China contains the fundamental forces that affect the competitive landscape of the industry through policy intervention.

In November 1949, following the founding of the People's Republic of China, the MPT was formally established and was mainly responsible for formulating development plans and coordinating nationwide networks. China's telecommunications industry, like other industries, experienced slow development before the late 1970s. Telecommunications service was considered an instrument of the government and military. Before 1998, China Telecom was once the only national operator and could be seen as a collection of separate, state-owned enterprises that provide service at the national, provincial and local levels. Consequently, MPT tended to defend the interest of this incumbent operator uncompromisingly by creating barriers for new entrants and cared little about the interest of individual customers in China.

In April 1998, the MII was formally established. It was the result of the merger between two ministries: the former MPT and former MEI. The MII is thus an extremely powerful ministry, and all networks and IT manufacturing industries are now subject to MII's regulation. Its main commitments include development strategy formulation, policy-making, overall regulation of the information industry, including telecommunications, IT product manufacturing and the software sector. Since MII no longer shares any common interest with the incumbent operator, we can see that the regulator currently enjoys a relatively neutral status. The establishment of the MII is

undoubtedly a positive step toward further deregulation of the Chinese telecommunications market and ensures more effective regulations over mobile operators for the benefit of the wider community.

The most revolutionary step taken by the MII since its establishment was to split the former China Telecom into four independent groups in mid-1999, namely: China Telecom, China Mobile, China Satellite and GuoXin Paging Company. The MII adopted a strategy of 'vertical separation' and the former China Telecom was finally split up into these four groups according to specific services. New China Telecom, however, only retained responsibility for fixed network services and China Mobile is specifically dedicated to mobile phone services; China Satellite is into satellite communications while GuoXin Paging Company focuses on radio paging services only. These new operators are financially and operationally independent. The GuoXin Paging Company subsequently merged with China Unicom to enhance China Unicom's financial strengths.

The regulator has paid much attention to the law and ordinance issued in 2000. 'The Telecommunications Regulation of the People's Republic of China' was promulgated by the State Council on September 20, 2000 and came into force on the same day. This regulation became the primary ordinance to cover nearly all aspects of the telecommunications industry, including market admittance, network interlinkage, charges, resources, service, construction and safety. According to the ordinance, mobile network service belongs to basic telecommunications businesses and any potential entrant will be subjected to the examination and approval of the MII under the State Council before it can obtain a business license.

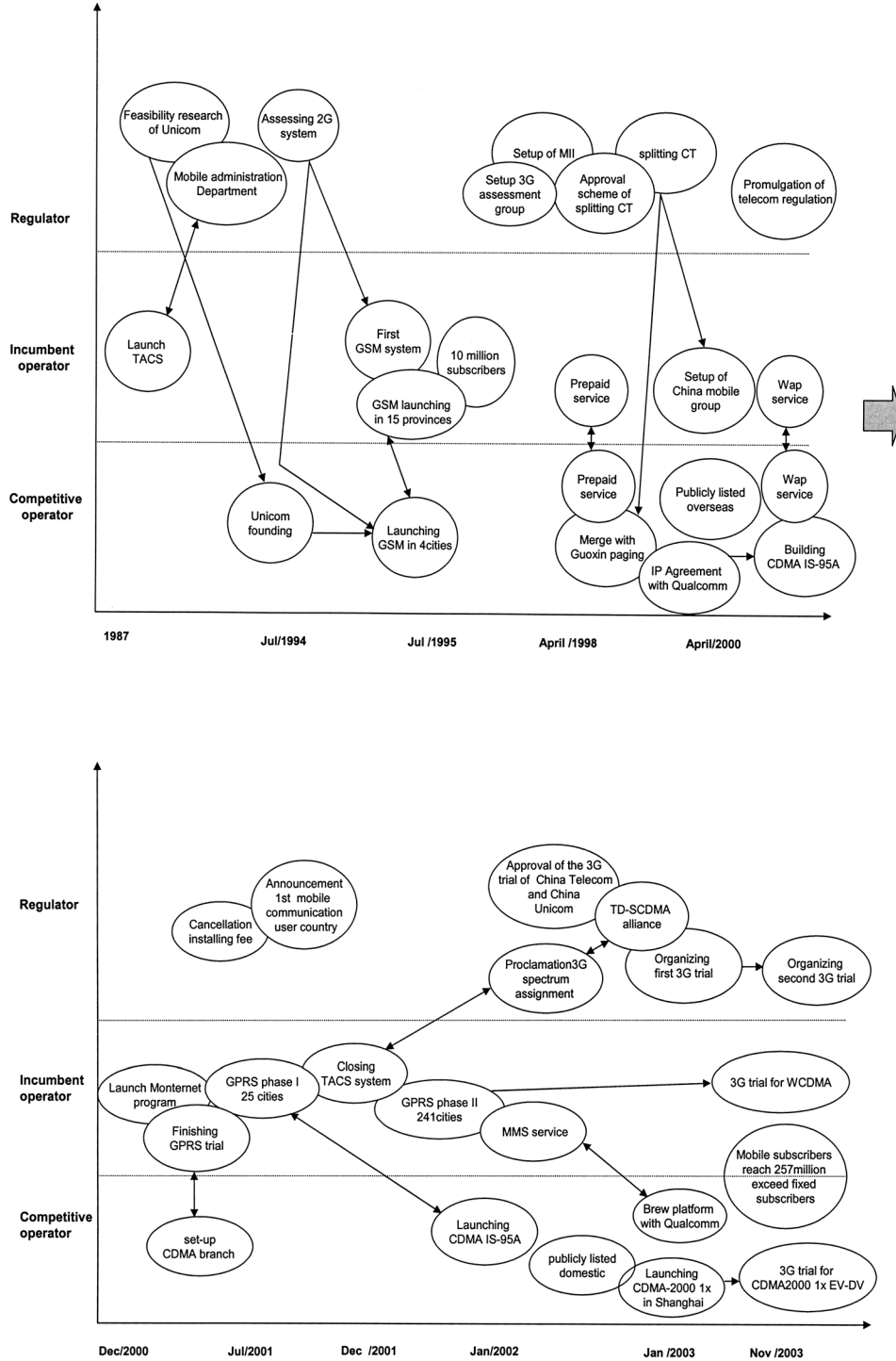
However, Chinese government still views the state-owned telecommunications operators as a combination of commercial, social and political cells of the government. Two mobile operators must make profits for the government and also get market protection from the government at the same time. MII not only supervises the whole industry, but also holds the power to appoint, promote or dismiss key officials of China Mobile and China Unicom, and the key to personnel decisions of the two operators are inevitably made beyond the level of their own boards.

4 Evolution mapping and analytical framework

4.1 Evolution mapping

As mentioned before, there are three major actors within the actor-networks of China's mobile telecommunications industry, which are the regulator, the incumbent (China Mobile) and new competitor (China Unicom). Mapping analysis was conducted to explore the interactions among actors in the industry and the linkages of their activities. The researchers focus on specifying each category of player in terms of the conditions of phenomena as to why, how and when; the set of circumstances in which phenomena are embedded; the actions or reactions of actors; and the consequences of the actions or reactions. The mapping chart here consists of two axes. The vertical axis contains the key themes and events of actors that influence the industry evolution process with a layered structure. Horizontal axis represents time. The total time span will cover the industry evolution history up to now (see Figure 2).

Figure 2 Mapping chart of evolution process of mobile telecommunications industry



4.2 Analytical framework

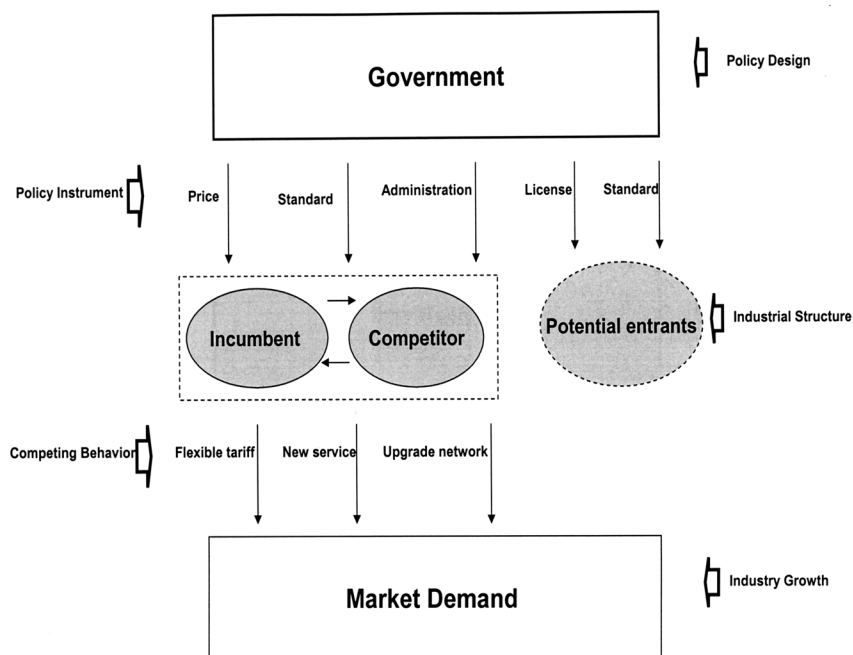
From the process mapping, we can see that the interaction among the members of the actor-network has greatly shaped the mobile telecommunications industry today, and will continue to do so in the 3G era.

The policy design of the industrial structure by the Chinese government is captured in the framework. Several policy instruments are adopted to adjust the changing status of the industrial structure. These policy instruments include price regulation that govern installation fees and call costs per minute; standard setting like the decision to introduce GSM and CDMA IS-95A systems; direct administration like appointing top officials of the operators. As to potential entrants, the government decides on the number and the timing of new license issuance.

The firm's behaviour and market performance can also be observed in the framework. Under government supervision, we can see that the two state-owned mobile operators tried to react to the fierce competition quickly and proactively. They tried to penetrate the market with flexible tariff, new service and upgraded networks. In turn, the improved services, customised contents and flexible prices (see Figure 3) triggered the purchasing desires of potential customers.

The policy design on the competitive market has really stimulated the recent quick growth of the mobile telecommunications industry in China. However, some problems, which need special attention, remain unsolved. For historical reasons, MII has a deep-rooted and intimate relationship with China Mobile, China Unicom, and other regulated operators. China's mobile telecommunications service industry is still administration-based. The frequent policy interventions by the government inevitably mean that many uncertainties still exist in the future industry development of this big developing country.

Figure 3 Industry evolution framework



5 China's road toward 3G

According to the 'Tenth Five-Year Plan (2001–2005) of Information Industry' approved by the State Council, China will become an information society with a large scale and technologically advanced national information infrastructure by 2010. The information and telecommunications industry will be the most important industry in the national economy. Apparently, the 3G systems will seem to play a key role by that time.

In July 1997, Chinese government established a '3G technology assessment group' in Beijing that began to visualise the future of the 3G in China. Now China is considering three rival technologies as the standard for future 3G networks. These are Qualcomm Inc.'s CDMA2000, which builds on the code division multiple access, the standard used by China Unicom; Wideband CDMA, which is European-backed and builds on the GSM, the standard used by China Mobile; and Time Division-Synchronous CDMA, or TD-SCDMA, a home-grown technology developed by China's Datang Mobile Communications Equipment Co. and Germany's Siemens AG. With a population of 1.3 billion, the choice of 3G system standards by China seems to have a remarkable impact on the future of world-wide mobile telecommunications industry.

The Chinese government insists that its intervention in setting standards for operators accelerates the realisation of network externalities and reduces technological or economic uncertainty. Unlike 3G auction practises in European countries, 3G licenses in China are granted to state-owned operators through an administrative tender procedure. Without any doubt, the first two 3G licenses will be granted to China Mobile and China Unicom, the only two existing 2G players. Their existing giant 2G networks will also restrict their 3G system development trajectories and options. They will choose WCDMA and CDMA 2000 1X EV-DV respectively. Furthermore, the competition will intensify with China Telecom, China Netcom and Railway Communications Corporation joining the fray for 3G licenses. These potential entrants from the traditional fixed telecommunications sector will greatly increase the uncertainty in China's future 3G. Since MII also has responsibility over the development of the domestic manufacturing sector, the commercialisation progress of the home-grown TD-SCDMA standard will be an important factor in the decision-making process of the regulator. Furthermore, the fear of existing state-owned mobile operators of reaping low profits will affect initiatives of the regulator to launch 3G services quickly. It was reported that MII would kick off a second round of 3G field tests in China in the beginning of 2004 after the first round is finished in September 2003 (China Daily, 2004a).

By intervening in the standard setting of the operators, the Chinese government will continue to have a great influence on the technical direction of existing or potential mobile operators. It seems that the more political, social and community dynamics will affect China to make the trade-offs among three alternative 3G systems choices. On the other hand, since the Chinese telecommunications market is as disparate as the nation's economic development, the 2G and 3G mobile networks will coexist for a long time in China (see Table 3).

Table 3 Evolution of the mobile telecommunications standards toward 3G in China

	1G	2G	3G*
Number of operators	1	2	5
Launch time	November 1987	July 1995	2005
Newcomers	China Telecom	China Unicom	New China Telecom, China Unicom, Railway Communication
Dominant standards	TACS	GSM	WCDMA, CDMA2000
Secondary standards	AMPS	CDMA IS-95A	TD-SCDMA

Source: *Based on the progress of 2003

6 Conclusion

This study provides a comprehensive overview of the evolution of the mobile telecommunications industry in China with a population of 1.3 billion. The interactions among the actors like policy interventions and market competitions are found to be the key drivers that form the evolution pattern of the industry and push the industry forward. The regulatory environment in China has greatly shaped the telecommunications industry structure, influenced the firm's behaviour and the industry performance. Both the telecommunications sector and the general public have benefited from the introduction of effective competition between the two mobile players instead of the monopoly by the incumbent alone. There are still many uncertainties in future development owing to frequent policy interventions. Furthermore, the industry will try to resolve the trade-offs between alternative technical choices of 3G mobile systems from the political, social and community perspectives. Undoubtedly, China hopes to play a more proactive and significant role in the future 3G area with its great potential market.

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