The Discussion of 3G Mobile Systems in China – Technology, Standards and National Interests

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1. Introduction

In the time of "network economy", industries and the public have stressed several "battles for dominance" between two or more rival technologies, often involving well-known firms operating in highly visible industries. China's 3G standard selection is no doubt the most high-profile case in the battles for dominance. The development of 3G service is perceived to have important economic and social impact. In addition, 3G is an important stake especially for developing countries. Successful development of 3G service can help developing countries shorten technology gaps with developed countries. But failure to do so could widen the digital gap further. Although most European countries and some East Asian counties have already launched 3G services, China's allocation of 3G operations was postponed again and again, until it promulgated TD-SCDMA as a 3G standard on January 20, 2006.

To understand the situation, we will introduce the 3G debate among scholars in China, which could give a brief idea of 3G concerns in China. Further, we will focus on the China's own standard TD-SCDMA, from technical essence to market value, and political implication. By analyzing the possible emerging standard, an interlaced interest chart between different interest groups will be illustrated. Since the decision power lies in the highest level of government, both in the decision of timing and the selection of 3G standard, our discussion will be based on the influence of government. The outcome of the standard setting often determines not only the fate of the winning and losing technologies and their sponsoring firms, but also of a whole array of complementary goods and services, even with positive or negative implication to the whole national welfare. In this case of 3G selection, the government influence appears particularly strong due to "socialist" system and the characteristics of telecom industry. Our final finding shows that, the government will have to balance and measure interests between different groups and sponsors, both on international and domestic levels. All the candidates including WCDMA, CDMA2000 and TD-SCDMA will be placed with some operator to take certain market share: none of the standards will be applied exclusively in the market.

2. Literature review

2.1 The economics of information industry

Telecommunications industry is a typical "network economy", which encompasses the Internet and entertainment, etc. These industries are all built on standards, by which to manipulate information and technology. In the literature part, we will introduce a model to understand the implication and dynamics of standard-setting/dominant technology in "network economics".

Standardization can be defined as a coordination process which results in the production of goods that are interchangeable or compatible (Farrell & Saloner, 1987). Standards can be divided into quality standards and compatibility standards: quality standards simply indicate that a product conforms to specific characteristics, while compatibility standards indicate that a product can be used with other specified products (David and Greenstein, 1990). Furthermore, compatibility standards can either be non-sponsored or sponsored, the latter being the case where one or more actors holds a direct or indirect proprietary interest in a particular technology and actively seeks to persuade others to adopt it. According to Farrell and Saloner (1986), three main benefits of compatibility standards are identified: interchangeability of complementary products; ease of communication (people-people, people-machines, machines-machines); cost savings because of possible mass production.

Paul (1996) indicates that standards in telecommunications system play a central role to maintain service quality, and standards will not involve tradeoffs between service quality and variety but will knit together advanced telecom networks in a seamless web of interoperable technologies and services. This means that the highest priority of standards setting is the interoperability, by which to establish technical compatibility and avoid unnecessary welfare loss. However, he also expressed the concern that "in practice, there are many reasons why such construction may prove difficult to achieve". Technical compatibility standards do not flow "neutrally" from the best engineering practice, but rather reflect the full range of strategic behaviors.

It has been widely agreed that a dominant design is often not the technologically superior one and is usually the result of a complex interplay between technological factors and user demands as well as political, social, and economic factors. Different technological designs backed by different sponsors compete for the position of dominant design through a process where economic, technological, and socio-political factors are intertwined. Technology is not isolated working -- coordination and compatibility with other products or systems are required. Generally, the more complex the product, the more actors aligned for a technological design, the more complicated sponsoring role. A complex system requires additional attention to many different interfaces and negotiation with different users and producers of complementary products, thus evolving from simple technological artifacts to more complex ones. (Tushman and Rosenkopf, 1992)

Because of the complexity, the process of emergence of a dominant design is often considered to be a “black box” involving a wide range of factors that are difficult to identify and measure (Suarez & Utterback, 1995). However, the “black box” can indeed be anatomized to some extent. Different factors influence the emerging dominant technology, as discussed below.

2.2 Emerging model of a dominant technology

Technological factors

The technological factors refer to the pure effect of technology, which can include technological functionality, reproducibility, and superiority that a technology needs to succeed in the marketplace. It can be understood that the better a technology performs, the higher the likelihood that it will become the dominant technology.

Market factors

Market factors play an important role in determining the dominant design and in promoting the use and acceptance of the new technology. A strong brand name can have a strong power and may strongly influence the dominant design in a particular technology. An effective and efficient distribution means a higher market share, which brings more opportunities to exert influence on the emergence of the dominant design in its favor. Also complementary assets and credibility refer to reputation, sales forces and manufacturing know-how and capabilities, which may take many years to develop. Since telecommunications involves a typical “network economy”, as we have mentioned, we are not going to discuss the traditional market factors like brand name or distribution network instead of the unique concept of “network economy”: network effects, switching cost and path dependency.

- **Size of a firm’s installed base, Network effects, switching costs and path dependency**

A larger installed base is associated with higher rates of adoption for a specific technology. The size of the installed base provides an “extra push” to increase the possibility of the specific technology to be a dominant one. This is derived from the effect of previous variables of the installed base. As a specific firm strategy, a firm can design its products to be compatible with a customer base that already exists on the basis of a previous technology.

Network effects indicate that the utility derived by a consumer is affected by the total number of consumers subscribed to the same network, in other words, the demand or utility curve shifts upward with the increase of the total users in the network, positively associated with the size of the network. As a customer, the adoption of a certain system will be partially dependent on the number of other consumers purchasing similar systems. Network effects can be divided into direct and indirect network effects (Katz and Shapiro, 1985). Direct network effects are present when a new customer joins a network, and a new network connection is created for all the members in the network. Direct network effects depend on compatibility between system elements. For example, the utility of one user of an email system increases along with the increasing number of total users in the system. Indirect network effects arise as a result of increased demand for complementary products or services including specialized training, after-sale support, compatible software, etc. -- a positive dependency obtains between the spreading of a standard and increasing demand for complementary goods. For example, the spreading of an operating system plays an important part in determining the supply of compatible application software. Katz and Shapiro (1985) found that firms with good reputations or large existing networks tend to ignore compatibility; while firms with small networks or weak reputations tend to favor compatibility. This is because large firms have the market power to ignore compatibility when introducing new systems. However, they are more interested in niche markets and may include compatibility with existing systems to reduce switching costs. The different incentives in the pursuit of compatibility between large and small firms can explain the different compatibilities from GSM to TD-SCDMA/WCDMA.

Some first-mover advantages may influence the emergence of a dominant design. If a firm can be the first to the market with a product of fair quality for a period of time, switching costs will prohibit them from using other competitive products because of its existing installed base. This means that switching costs can have an effect, attracting or losing customers according to its cost switching from one installed base to another. It follows that the higher the switching costs, the more difficult it is for a firm to attract customers away from rivals, which results in a more loyal customer base. For instance, it is agreed that network effects for end users of wireless technologies are weak: users of any network can call to users in other networks seamlessly because the network operators have made all networks inter-operable. However, once they have joined a network, users may be reluctant to switch to another network if switching cost is complicated or high, for instance changing their telephone number.

From a path dependency perspective, a firm’s ability and incentive to adopt a newer technology largely depends on its level of related experience with prior technologies. When using previous generations of inter-organizational system, firms have fostered skills for inter-organizational system implementation, and developed a deeper understanding about the economic and organizational impacts (Lyytinen and Robey 1999). Acquired primarily through learning-by-doing, such skills and knowledge are critical for successful adoption of new technology standards.

Economic factors

Economic factors that promote the emergence of a dominant design can be divided into demand-side and supply-side forces. On the supply side, the manufacturers will seek improved efficiency through economy of scale allowed by the emergence of a dominant design.

Political factors

Political forces influence largely in the making of a dominant design; they are complicated, difficult to predict and full of variables. Paul observes that government regulatory bodies may have an interest in standards setting for many reasons, because some government agency holds authority to regulate the industry’s firms. They perceive that the result of standardization activity affects important national goals, such as protecting domestic employment or maintaining defense capabilities. However, Paul asserts that there is no possibility of attaining higher social welfare by intervening in the process to mandate standards that represent a socially optimal trade-off between variety and the benefits of inter-operability. He explains that the requirements for intervention are the ability to accurately specify the social opportunity costs of a mandated standard in suppressing innovative variety, and the ability to enforce such a standard. He asserts that it is difficult to assure that any social opportunity costs lock in any particular mandated standard at an early date.

Paul observes that standard setting is complex in practice: the role of regulation in the process may present vexing problems to government agencies. He said that it is well known that the arguments are made in favor of government intervention on the grounds of efficiency gains; however, there is less discussion about the potential losses imposed by the regulatory process. According to Paul, first, some groups systematically acquire more influence than others because they are unequally represented when the issues are arcane. Even though the government would like to require that all relevant parties be represented, not all parties can be identified. This can be understood as unequal information distribution and power of obtaining. Second, government intervention will also tend to accentuate identifiable "vested" interests.

He points out that national governments have incentives both to promote and to discourage the adoption of inter-operable compatibility standards in telecommunications services. The incentives to promote standards arise when compatibility standards will contribute to user welfare, while having either positive or negligible adverse effects on domestic producers. When governments must weigh the promotion of inter-operable compatibility standards against the demise of a domestic producer or the compromise of other perceived national interest, common international standards or inter-operable compatibility standards are likely to be sacrificed. He said that it is difficult to avoid encouraging the view that domestic producers of telecommunications services may be ideal candidates in infant industries that could achieve a world-class competitive status with the help of a government procurement contract. As well, the national political appeal of some international revenue or employment shifting toward the home country is likely to be potent. He raised the question, is it desirable to favor standards advantageous to domestic producers due to their local contribution to employment, national culture or other considerations? In these contexts, he observes, it is often best to weigh consumer losses heavily and treat producer gains more skeptically. He finds out that, the first will often tend to be underestimated while the latter will be overestimated. But he gives a proposal that, one way to preserve domestic market position is to mandate or promote the use of compatibility standards to achieve inter-connectivity rather than inter-operability. Inter-connectivity assures that two devices may be connected through a converter or bridge that renders them mutually compatible. No doubt, a government policy favoring inter-connectivity is likely to provide more opportunities for domestic production, and he warns again, such protection must be weighed against the possibilities of retaliation and more importantly, large consumer welfare losses arising from promoting "inferior" standard.

Strategic factors

Various strategic factors can also influence the emergence of technology standards. Appropriability is the ability of an innovator to protect its innovation from imitation by competitors and to capture the profits generated by the innovation. A firm might be able to protect its technological innovation with a number of patents in such a way that other companies find it difficult to invent competitive products without paying license fees. Characteristics of the technological field refer to the ability of reaching agreement with other actors in the technological field, including producers of complementary products or services and customers. It is dependent in part on the structure and dynamics of the technological field itself, for instance, the number and relative power of each actor and the level of cooperation versus competition (Garud and Rappa, 1995).

Factors influence Dominant Technology (Black Box)

Indicator	**Description**
Technological factors	Technological functionality, reproducibility and superiority, etc.
Market factors	Brand name, distribution network, complementary assets and credibility,
	Installed base, path dependency
	Network effect and switching cost
Economic factors	Supply side and demand side forces
Social and behavioral factors	Ease of use, Resistance to change, Communication between producer and user
Organizational factor	Interactive learning，Powerful user, Powerful producer, Alliances
Political factors	Regulation and government intervention
Strategic factors	Appropriability, *Characteristics of the technological field*

2.3 Infant industry

The infant industry theory is an argument for government intervention for a limited time period only to correct a transient distortion. According to List, some nations may give more weight to their own welfare. If so, that nation would be interested more in expansion of productive forces of the country through infant industry protection than in maximizing the welfare of humanity at large through free trade. If the infant industry is open to foreign competition at early stages of its development, the producers will suffer and their industries will be ruined. List argues that protection of domestic industry and the resulting monopoly would permit an eventual reduction in costs and prices allowed by the exploitation of the domestic market. Moreover, eventually the gradual introduction of domestic competition would safeguard the interests of consumers.

Obviously, one of the reasons for protecting an infant industry is to stimulate the learning effects that will improve productivity. Infant industry argument suggests that protecting the domestic industries from foreign competition results in generating positive learning and spillover effects. Protection would stimulate domestic production and encourage more of these positive effects. As productivity improves and other industries develop, economic growth is stimulated. Thus by protecting infant industries a government might facilitate more rapid economic growth and a much faster improvement in the country's standard of living relative to specialization in the country's static comparative advantage goods.

3. Background: Overview of China Mobile industry

According to China’s authority, the MII (Ministry of Information Industry), the number of mobile subscribers in China was 120.6 million in July 2001, a little more than the 120.1 million mobile subscribers in the US at that time. Before 2005, 349.1 million of subscribers were using mobile services. There are mainly four telecom operators in China market. China Mobile is largest telecom operator in China. China Mobile runs GSM system and provides their services in 31 provinces of China with roaming facility in 240 cities. China

Unicom is the only Chinese operator that has a license to provide a full range of services, including mobile, long distance (domestic and international), VoIP, data, the internet and broadband. China Telecom group is the first operator for fixed line service. China Telecom is the second largest operator after China Mobile in term of revenue. China telecom also provides limited fixed services in north China. China Netcom (China Network Communications) was created in 2002 in an effort to break the monopoly by China Telecom in the fixed line service market. China Mobile earns around 35.6% and China telecom 31.6% of the total revenue of the telecom service industry. Chinese mobile market has some competition but fixed service is still monopolized. In the mobile segment, China Mobile is the incumbent operator with 55% market share.

In Europe, GSM started comprehensive commercialization in 1994, and reached the highest growth rate in 1997, which started to decline after 2000, when the penetration rate of mobile phone arrived 70%. In 2003, the newly added mobile subscriber rate in Western Europe fell to 6%. Obviously, the Europe mobile market has entered the saturated stage, with no further room for development. At the same time, competition intensified -- reduced fee caused the depreciation of users' ARPU (Average Revenue Per Unit) value. All of these led to declining gross income of telecommunication business. The telecommunication industry came across a serious crisis: the voice market became saturated and the telecommunication revenue stopped growing. Obviously, telecom industry in Europe had to seek a new growth generator, or it could fall into a deeper crisis. New growth will be derived from data service. Alongside the saturated voice business, the data service was on the rise actually. By 2000, data flow in the European and American markets started to surpass voice data flow in telecommunication networks, and became the major data flow. Since the stagnation in voice business is inevitable, the hope of mobile communication growth surely lies in the data service. Obviously, these markets were under the saturated voice business condition when they pushed 3G business, so their 3G strategy was mainly aimed at mobile broad band data service market. At the same time, due to the necessity to construct an expensive and incompatible new network, 3G becomes a huge gambling risk, while the data service business became the determining factor of successful 3G. China mobile communication market sped up in 2000. From 2001 to 2004, the mobile subscribers increased by 60 million every year; by the end of 2003, mobile subscribers amounted to 270 million, with the coverage of 21% (by the end of 2004 it was 334 million and 25.9%).   A striking contrast appeared between the fast developing China mobile and stagnation in Western Europe. It is estimated that China’s mobile market will enter into saturation after reaching 500 million users. China's mobile communication market still has a large room for expansion. (Hu Leming, 2005)

4. 3G debate in China: Pros and Cons

Unlike the European countries, Japan and South Korea, even India, China has decided to launch 3G; and the schedule of 3G has been postponed repeatedly. The two main camps are represented by Prof. Hu Angang, an economist from Tsinghua University and Prof. Kan Kaili, a telecom expert from Beijing Post and Telecom University.

4.1 Pros: An open market for 3G

Hu argues that China is a typical and successful new technology participant, becoming the world’s first telecommunication consumer in only about ten years. He attributes the success to the open market policy, which encourages the use of the most advanced technology. It is also argued that China’s telecom history has proved that the significance of open market is much more profound than reform of China telecom system. The essence of the open market policy is to win large amount of international capital, cutting edge technology and involvement in international competition. He argues that the fundamental driving force of telecom industry is the open market policy, which is characterized as technology-intensive, knowledge-intensive, competition-intensive and highly internationalized. The openness and boom of 3G market will be a new opportunity for both China's national economy and IT industry. Hu's argument is mostly based on the classical economics of free trade. He believes that only by participating in the world competition can China's manufacturers learn to be more competitive and the consumers obtain the final benefit.

As Paul suggested, standardization affects important national goals, such as protecting domestic employment, etc. Hu gives his argument from the point of view of the national welfare that the launching of 3G will definitely benefit the whole country. He estimates that telecommunication industry has become one of important generators of the nation's economy. He also estimates that, within 5 years of 3G launching, it may contribute to the newly added GDP by 1/8 to 1/6, which amounts to 1.2% of the total GDP. Particularly, he points out that, 3G will create 0.8 to 1 million employment opportunity for the country, which will approximately compose 1/10 to 1/8 of the newly added employment. This will effectively alleviate the country's stern employment pressure. In addition, he also argues that the launch of 3G is an opportunity to promote the country as an IT exporting economy and boost the country's informationalization speed, due to its large investment in information infrastructure.

He also asserts that the primary purpose of an open market is to meet the needs of consumers and technology development. The "open market" could include technology transfer; therefore domestic industry could develop by the strategy of "purchasing-introduction-digestion-innovation". He suggests a focus on "market friendly, competition friendly, technology friendly and user friendly" technology instead of favoring a specific manufacturer. In general, it is to be beneficial to everybody, firstly to consumers and then to manufacturers, operators and ICP's, etc. through the open 3G market in China.

Regarding the patent fee, Hu differs from the others. He claims that there is no free lunch in the world—patent fee and copy right trade off are the same as the toll in highway, where the cost is necessary if you want to access the road. He even argues that the action of copy right trade off should be taken by manufacturers instead of the government. He suggests that the government function should focus on promotion of technology innovation and protection of the copy right. Manufacturers should be smarter than the government in the decision between paying for or building a highway by themselves, according to Hu. Manufacturers have more knowledge in the nature of technology in terms of production cycle, application cycle and commercialization cycle, etc., therefore they are more qualified to make the choice. Government role could shift from standard setting to a more macro view -- creating a competition mechanism where everybody in the market is running and competing all the time in order to catch up with the ever changing progress.

Specially, he points out that in the economic transformation period, there is a prominent phenomenon called 'government captured', which means that relevant national departments or public policy is affected or captured by the minority vested interest groups. This caused public policy, public investment and public resource to be assigned advantageously to these groups, at the expense of the entire social benefit and the overall welfare. He criticizes that certain departments or groups frequently take the so-called national interest and national security as an excuse. It results in public policy malfunction, obstacles and monopolized market, while certain public policies degenerate into special policy or preferential policy for certain departments and special interest groups.

4.2 Cons: No market demand or technology advantage

From Prof. Kan Kaili's point of view, 3G is not ready to launch in China for lack of market demand or technology advantages. He points out that the manufacturers want to increase their revenue in China and the operators without mobile license want to take the opportunity to enter the mobile market—that forms the major force of 3G promotion in China. However, he observes that, in this debate, consumers' benefit has been ignored: for example, there is no voice about whether they have demand for mobile broadband service or what the appropriate price should be. Kan argues that, in the value chain of telecom industry, the fundamental origin is the demand from users. However, in the debate about 3G in China, the voice from consumers is actually inaudible -- therefore the debate has already lost its significance, according to Kan. He is aware that the major propellant in the debate is multinational equipment manufacturers, who are interested in China's mobile market. They push domestic manufacturers to be the anxious partners to promote 3G in China---this is widely divergent from Kan's routine view that market demand is the driving force in market economy instead of the producer's interests. He also criticizes that those activists disregarding market demand and economic value will inevitably result in defeat. His argument can, to a certain extent, be supported by Paul's theory. Paul has already indicated that even though the government would require that all relevant parties be represented, not all parties can be identified, and some groups systematically acquire more influence. The group of customers is definitely the weak group in the debate, and their voice and interest have not been identified by the government. The balance of scale is excessively tilted to the supplier's side. The blind investment can bring negative economic effect: for instance, the blind investment in the 90's caused the bankruptcy of massive telecom companies. Iridium technology was a huge success in technology, but insufficient market demand led to its bankruptcy and staged one of the disastrous losses in telecom history. In addition, he mentioned that crucial problem of the unclear application prospect. Most of the data service including email, SMS, etc. can be utilized in narrow band service. The demand for high speed data service in moving status is very rare. Kan observes the emerging 3G introduction from the perspective of economic factors, which we have introduced in the dominant technology model. His concern, clearly, is that the launching program of 3G is indeed manipulated by international and domestic mobile manufacturers seeking their own profit. However, on the demand side, customer demand is not yet cultivated and deficient. His opinion indicates that the unilateral economic driving factor, which only comes from the supply side, cannot turn into the full argument for the launching of 3G in China.

He maintains that economy value is the only criterion to test technology, especially in the days of capacity surplus in telecommunication technology---according to the US statistics, more than 90% optical cable capacity was left unused; while the percentage in China is higher). For example, in China, optical cables at 10 8×2.5G transmission speed are not used up, let alone the newest several dozens T technology (each T is equal to 1,000 G).

Kan's most astonishing standpoint is his evaluation of 3G technology. Kan argues that, 3G technology has already degenerated into an obsolete technology and has already degenerated into a substitution. The 3G network established by mobile operators laboriously is gloomy in the impact of WiMAX. It is also said that the WiMAX technology (need to confirm) has received great attention, and already obtained support from handset manufacturers and fixed telephone operators. In Kan's opinion, 3G is rather slow in network speed and the unit coverage of 3G station is only 1/10 of WiMAX, since WiMAX users can carry on data communication at high speed within 50 km. According to dominant technology model Kan is challenging the technology superiority of 3G technology; he asserts that with the born defects of 3G, newly emerging competitors can fundamentally ruin the base of 3G as a new standard.

Kan argues that, in the past decade, the driving force for China telecommunication industry is the huge market demand, whereas nowadays, the demand for market capacity and technology advancement has already slowed down. It will cause overstock if the industry depends on technology advancement and market capacity expansion as a telecom reform method. He asserts that according to present market demand and technology development status, 3G will be washed out of the market in a few years, like ISDN. Some commentators have issued warning that 3G may be in danger of being squeezed between evolving technologies. On one side is the so-called 2.5G technology (GPRS) and on the other is the advent of fourth generation (4G) technologies as well as wireless computer-networking technologies (Wi-Fi). (Kan Kaili 2005)

No one can judge whether Hu or Kan is right for the policy. Both of them raise their argument and opinion from their specific point of view. Hu focuses on the market effect and industry influence. As a prominent economist, he gives his insight based on classical economics, effectively promoting the concept of open market and technology neutral policy. However, he is not concerned about details of different technologies. Kan, as a telecom expert, observes the problem from a technological perspective. His judgment of obsolete 3G technology is astonishing. His argument about the China’s telecom capacity surplus is also impressive. However, this concept could actually prevent new technology and innovation from spreading, and turn into resistance against improvement.

5. TD-SCDMA’s chance in an emerging dominant technology model

We have introduced the emerging dominant technology model, which will be used to discuss the possibility of TD-SCDMA becoming a dominant technology. TD-SCDMA is actually the central concern in the decision and selection of China 3G standard, which is why we choose only TD-SCDMA for an analysis instead of the other two.

5.1 Technology factors

China has three options including TD-SCDMA, which China has its own property right， and two global standards WCDMA and CDMA2000. The three 3G technologies have various technical advantages and disadvantages, but they also have particularity with regard to deployment in the Chinese market. It is difficult to estimate the 3G licensing framework in China by the experience of other countries, because countries with different economic background may be concerned about different aspects of 3G development. Choosing a technical standard is not just a technical issue, as the standard has broad economic implications beyond the mobile service itself.

In the US, the 3G alternative is CDMA2000. The standard was developed by US company Qualcomm. The advantages of CDMA2000 include a direct upgrading from CDMA2000 1X (lower speed) with less investment as compared with upgrading from GSM to WCDMA; a higher product maturity compared to WCDMA; a smaller investment cost for the network in short-term; large-scale commercialized non-core frequency band product, with rich experience in network design and network optimization. CDMA20001X also has more types of commercial terminals, which already surpassed 300 kinds. Some of CDMA2000's shortcomings include: smaller scale effect in future; limited global roaming ability especially in Europe; immature core frequency band product; GPS synchronization required. In Europe, the dominant standard is WCDMA, which is chosen mainly to support existing GSM infrastructure to save the cost in migrating to 3G. Since GSM is the dominant service in the world, WCDMA is often considered the most mature and widely supported standard. Obviously, superiorities of WCDMA include the scale effect, and strong global roaming capability, since the GSM network users account for more than 70% of the mobile subscribers. WCDMA has already developed its core network, which is a commercial product based on R4 soft switch framework; WCDMA uses asynchronous and the synchronous mode, which means the risk is small. The WCDMA inferiority is displayed in: standard and product maturity is lower, with frequent edition renewals; less commercial terminals; at present the commercial users are few; the market is waiting for further cultivation. CDMA2000, WCDMA are both the mainstream technical standards, and TD-SCDMA has typical Chinese characteristics; regarding technology, CDMA2000 and WCDMA are the FDD (frequency division duplex) standards, but TD-SCDMA is a TDD (time division duplex) standard. The wireless transmission technology of the systems are all based on DS-CDMA (direct sequence code division multiple access) as multi user accession. It is said that if only considering technology, WCDMA and CDMA2000 have their own advantages in technical advancement and product maturity, but generally speaking WCDMA is even better. On the other hand, TD-SCDMA was proposed two years later than CDMA2000 and WCDMA, and the initiator does not have the worldwide reputation and experience as the other two. TD-SCDMA technology does not seem as convincing as the two mainstream standards. Ji Yuqing (2005), Liu Jin (2005)

The advantage of TD-SCDMA is that it can provide a gradual and seamless transformation from the 2G network to the 3G network through available transmission linkage. It enables a smooth transition from a current GSM system to future 3G systems. The TD-SCDMA is designed as a dual-band and dual-mode system. The application of smart antennas and low chip rate can improve the efficiency of spectrum usage significantly, about 3-5 times compared to GSM. The feature is particularly valuable to the increasing mobile internet applications. The application of smart antennas will significantly save energy and improve the power efficiency of the base stations. Finally, the application of software-defined radio enables multiple features on the same hardware platform. The disadvantages of TD-SCDMA revolve around various uncertainties and unknowns regarding the technology. It is technically less mature and less advanced in development than the other two. In addition, TD-SCDMA is far less recognized on the international stage. The disparity between TD-SCDMA and WCDMA/CDMA2000 is due to various reasons. The first is the serious shortage of financing for the China developer. The development of 3G technology demands large research funding, but the market of TD-SCDMA is not promising, which indicates huge investment risk. Restricted by stringency in budget and financing, Datang has suffered talent loss for many years. The second is the problem of patent proprietorship. A complete set of 3G standard covers more than a thousand patents, which are held by numerous manufacturers, while some basic patents are possessed by few manufacturers. Datang's patent in TD-SCDMA accounts for 7.3%, and the majority of TD-SCDMA patents are held by transnational giants. For instance, Datang has 104 patent items, while Qualcomm has 726 items. Even in the 132 TDD category patents, Datang has only 7 items. Since TD-SCDMA needs to build on the WCDMA core network, it is impossible to avoid the WCDMA transnational giant. The entire TD-SCDMA patents are distributed in Nokia, Ericsson, Siemens and other international corporations (Yan, 2005).

5.2 Market factors

Compared to WCDMA and CDMA2000 initiators, TD-SCDMA is developed and promoted by a domestic and less influential Chinese company Datang. This means that TD-SCDMA has less advantage to compete with the international rivals in terms of brand name, distribution network and other market factors. Qualcomm controls most of the proprietorship in CDMA technology especially in those physical link patents. It has established its super competitor position in the competition of 3G standards. Although CDMA only occupies 12% of the global market share, Qualcomm provides more than 90% CDMA mobile chip, which represents considerable influence on the three 3G standards. In addition, Qualcomm collects patent fee from CDMA mobile terminal and equipment manufacturers. Now it is concentrated on standard design, chip development and platform design. Besides, Qualcomm designed BREW platform, also very profitably. In the European camp, since the European standard GSM occupies 70% of the world mobile market, Ericsson holds the core patents of GSM technology, and accounts for about 40% of the system market internationally. Most EU manufacturers including Nokia, Ericsson, and Siemens are focused on the development of WCDMA, though Ericsson also participates in the development of CDMA2000, and Siemens participates in the development of TD-SCDMA. Nokia is the most potent competitor in 3G technology by right of its excellent market strategy, and it possesses the largest percentage of patents in WCDMA technology. Nokia presents considerable competence ranging from chip development, system equipment, terminal equipment, to mobile operation system and platform design. It accounts large share in mobile terminals, which provides stable and ample R&D capital in 3G development. Nokia has been the dominant player for the CDMA2000 evolutional technology CDMA20001XEV-DV; it also holds the largest percentage of basic proprietorship in TD-CDMA technology (Lu, 2003). Compared to the resplendent achievement of these competitors, Datang and other Chinese manufacturers' influence is puny and reputation is far from established. The name of the manufacturer is only limited within the border of the country, and it is difficult to see the possibility that any foreign country would adopt this type of 3G standard---obviously, Datang and other TD-SCDMA alliance manufacturers do not have any advantage regarding the complementary assets. Incontestable, those international giants have also established strong and stable distribution networks including in China market. Dangtang has no influence in international distribution networks, since it is still a newcomer in the competition. However, as a domestic company especially with government support, it is quite possible for the company to set up a brand new distribution network relying on TD-SCDMA industrial alliance and tremendous government support. But this is not the existing advantage in distribution network, and it still takes time and risk to achieve the target.

- **Installed base, network effect and switching cost**

According to MII (2005) data, until August 2005, there are 211 3G commercial networks worldwide, among which there are 78 WCDMA networks, 21 CDMA 2000 1X EV-DO networks and 112 CDMA 1X networks. Along with the improvement of WCDMA technology, network equipment and terminal, the amount of commercial networks of WCDMA develops rapidly with gradually increasing percentage. There are 133 WCDMA licenses issued and 78 networks have been commercialized --- from this point of view the commercialization of WCDMA still has large potential. As to the subscribers, by June 2005, there are 191.9 million 3G subscribers: 143.7 million for CDMA 2000 1X, 30.4 million for WCDMA, and 17.8 million for CDMA2000 1XEV-DO. Although CDMA 2000 1X still attracts the majority of users, this advantage is gradually diminishing. Along with the resolving of terminal bottle-neck problems and increasing of the number commercial networks, newly added users for WCDMA have increased dramatically in 2004. CDMA 2000 1X shows a tendency of decreasing since 2004, while CDMA 2000 1X EV-DO increases slowly. China's TD-SCDMA has not been commercialized. Recently, under government support, 5 stations of

TD-SCDMA equipment are sold to Romania. This is the first case of TD-SCDMA application stepping out of the country's boarder. Still, these data reveal that there is no installed base on the side of TD-SCDMA. It seems that CDMA2000 takes up the advantageous position both in networks and subscribers. However, considering GSM's dominant position in worldwide, along with the optimization of WCDMA technology, there is a substantial potential for installed base in the foreseeable future. Since TD-SCDMA is also designed on GSM system, there is also possibility of future installation radiated from the existing GSM installed base. However, regarding the current 3G installed base for the three standards, TD-SCDMA's base is blank.

As we have discussed, TD-SCDMA has not installed visible networks, the network effect can contribute nothing to it. However, both WCDMA and CDMA2000 have shown cogent potential in network effect. But regarding switching cost, TD-SCDMA still has slight advantage since it is based on the technology of GSM. Switching cost is crucial during the transition from 2G to 3G. From worldwide experience, the newly constructed 3G network can be minimally competitive if it excludes the functionalities of 2G networks including international roaming. All the 3G operators have to develop 3G networks based on the available 2G networks, which enables users to switch between 2G and 3G networks. The proposal of TD-SCDMA standard is indeed to meet the evolution of GSM network. The originally TSM version of TD-SCDMA is based on GSM core network, and in the recent LCR version, the adopted WCDMA core network is also interoperable with GSM network. In addition, both the GSM and TD-SCDMA wireless networks involve TDD technology, and they have quite a lot of similarities in network plans. In a word, some experts assert that TD- SCDMA is the 3G technology, which can naturally adapt to the evolution of GSM networks, and the technology advantage can properly remedy the bug in GSM networks, including shortage of bandwidth. TD-SCDMA also has some interoperable features with WCDMA technology.   It is estimated that 85% of technology between TD-SCDMA and WCDMA is interoperable and inter-compensatory. Except for radio frequency, core networks of TD-SCDMA and WCDMA are all the same based on 3GPP standards. GSM association even said that it is possible to bind the two technologies together to develop further. From this point of view, although there is no network effect theoretically for TD-SCDMA, some of its technical features naturally determine that this standard can be constructed on the GSM infrastructure and benefit from network effect of GSM system.

5.3 Political factors

Chinese government has deliberately postponed the launching schedule for 3G again and again. Industry has already lost patience, extremely disappointed by the pendulous attitude. The speculated date of launching can be traced back to few years ago; then it was delayed repeatedly, until it is guessed as late as 2008, when China hosts Olympic Games in Beijing. It is widely speculated that the waiting policy of Chinese government is aimed at time conservation for TD-SCDMA improvement, or even for more advanced version of WCDMA or CDMA2000. But the government support for TD-SCDMA development is obvious and indubitable. It is shown by the authority's spectrum allocation and industrial alliance promotion for TD-SCDMA.

The radio spectrum is an enormously valuable and scarce natural resource. According to MII document, WCDMA standard obtains core frequency band of 60M and the expansion frequency band of 60M; CDMA2000 standard obtains the same; TD-SCDMA standard obtains the core frequency band of 55M and the expansion frequency band of 100M, ranging from 1880M to 1920M, 2010M to 2025M, and 2300M to 2400M. Although the allocated frequency to the three standards is all located in the core frequency according to ITU regulation, the 2300MHZ to 2400MHZ which has been allocated to TD-SCDMA is carefully planned by the government. Since this specific frequency band used to belong to military use, the government specially cleaned up the frequency in the interest of TD-SCDMA. The attitude of most foreign countries to TD-SCDMA is not positive. Many of them have already allocated the core frequency to the two main stream standards, which makes it difficult for TD-SCDMA roaming to other countries. However, if China can successfully commercialize TD-SCDMA in this two expanded frequencies, it is also possible to influence neighboring countries, or even worldwide -- the frequency between 2300 to 2400 MHZ has not been occupied in most countries. (Ren Leyi)

MII gives vigorous support to TD-SCDMA development, arranging special funds as part of mobile projects and electronic development funds. MII (Ministry of Information Industry), MST (Ministry of Science and Technology) and other government departments have invested 1 billion RMB ($120 million) since late 1990s, involving nearly 3,000 scientists and engineers across the country. In 2002, MII established the TD-SCDMA industry alliance with other ministries. They also support theoretical research in TD-SCDMA, including design and R&D in crucial chips, system, antenna, terminal, network plan, testing and construction. MII invites more and more Chinese and foreign manufacturers to join the alliance. At present, more than 50 manufacturers are engaged in the development of TD-SCDMA. The members of the industry alliance have increased from 8 to 21. A basic industry value chain has already been established. (Liu, 2005)

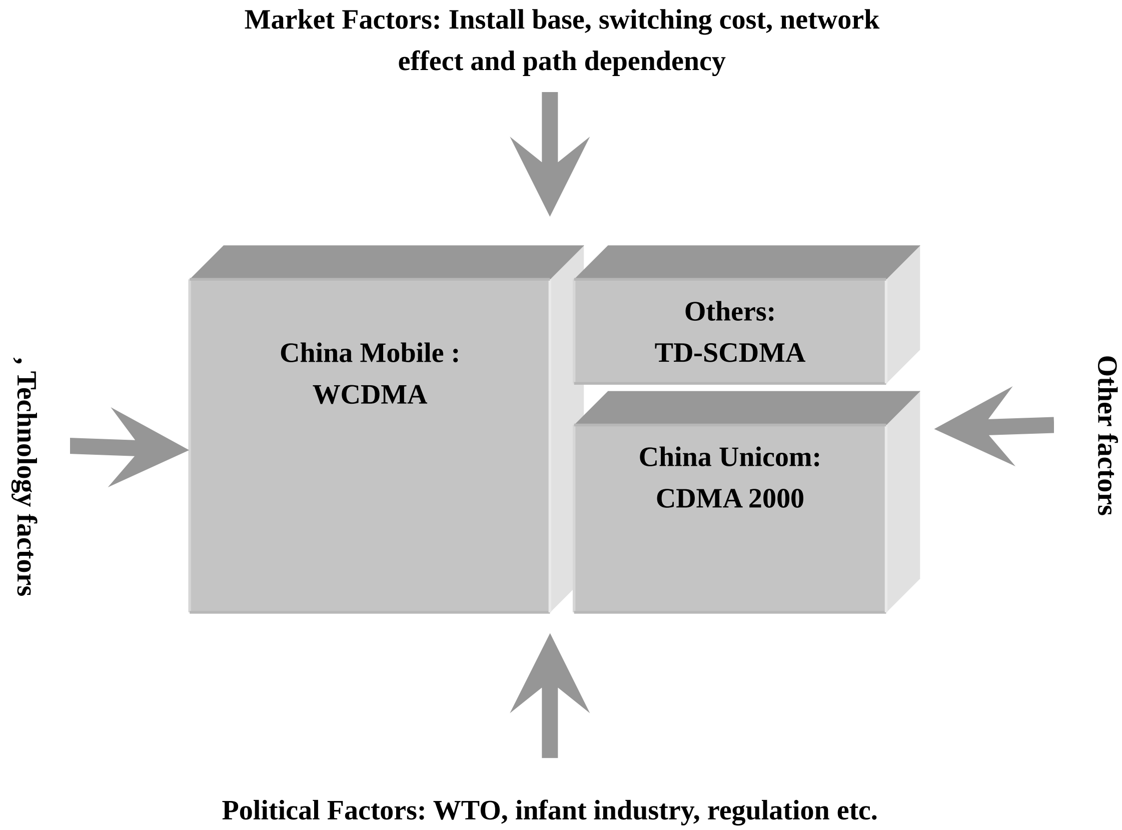
5.4 The possibility of TD-SCDMA

As 3G in China will be a US$100 billion market, the decision will have significant implications for operators, domestic manufacturers and foreign vendors. At present, Chinese manufacturers have invested large amount of research fund in 3G standards. For example, Huawei invested 1 billion RMB in 3G research, including CDMA2000, WCDMA and TD-SCDMA, from network to mobile terminal. The Ministry of Information Industry (MII) has kept silent on which standard China will adopt. According to the dominant technology model, it is clear that, TD-SCDMA does not have obvious advantage over the other two regarding the “hard” and “soft” conditions: technology, market, network effect, reputation, install base, etc., but TD-SCDMA possesses extra assets in political factors, namely the official policy bias covering spectrum allocation, financial subsidy and others. Based on the analysis by this model, TD-SCDMA has small possibility to win in the harsh competition. However, no one can assert that TD-SCDMA will be washed out in the final round, because the selection of a technology standard is much more complicated than the selection of a technology, as we learned from the previous theory. The selection of a technology standard can really be regarded as a “black box”, where lots of tact and strategy have been manipulated clandestinely.

Opinions also diverge on the number of 3G licenses that should be granted. Those in favor of more licenses believe it will promote competition, while those for fewer licenses maintain it will minimize duplication. This proves Sadahiko’s argument that a single standard is not always the case for various reasons, and may not always be desirable, as it eliminates an opportunity for different technologies to compete with each other, while a single standard will create and build up a market more quickly than in the case of multiple standards. (Sadahiko Kano). Generally speaking, it is estimated that China would select more than one standard because of the huge market size.

By its technical features and conditions, TD-CDMA is insufficient to form an independent network. Operators are not willing to keep the gambling stake in a technology which is immature and has never undergone the market test. It is also unnecessary for the government to let market-driven enterprises take such risks. It is difficult for the MII to take a technology neutral stance; this also proves Paul's argument that for a government, it is difficult to refrain from encouraging a domestic producer which could achieve a world-class competitive status with the help of a government procurement contract. Therefore, MII would like to use 3G as an impetus to China mobile industry. However, due to the fact that both China Mobile and China Unicom have been partly and indirectly listed in overseas stock markets, the MII would not like to force operators to adopt a specific standard, as this might give investors the impression of an excessive government intervention and a characteristic of the "socialist" market. This could give an unfavorable profile to these operators. China's accession into the World Trade Organization (WTO) also brought some restraints on the elaboration of the MII intentions. Balancing the above interests, it is very possible that TD-SCDMA will occupy a position in China 3G market, and WCDMA and CDMA200 will also be considered from the political and diplomatic point of view or for the continuity of the current national assets.

Therefore it is considered as the most possible solution to construct a hybrid network which includes WCDMA and TD-SCDMA. The government could require a fixed network proportion for TD-SCDMA. China hopes that, after 3G mobile systems come into operation, the TD-SCDMA standard will play its due role in promoting the development of this promising industry. As a natural continuity of GSM/GPRS, China Mobile will obtain a WCDMA license indisputably. Actually, China Mobile is a monopoly role in wireless market in China; so the government will give those weaker and newer operators some policy support. China Unicom has its advantage in adopting CDMA2000, since it is a rather economic way to transform its existing CDMA network to CDMA2000---the cost of transformation is lower than that of the GSM/WCDMA. It is estimated that China Mobile's first choice is mostly WCDMA technology, even if it uses the TD-SCDMA technology, it is only supplement to WCDMA. However, the possibility of China Unicom of choosing TD-SCDMA is very small. China Unicom has already shifted its gravity to the CDMA network; TD-SCDMA and CDMA2000 have enormous differences in technical details, and it is hardly possible to unite the two networks. China Telecom and China Netcom are possible to get TD-SCDMA license. But there is still a big variable in the network layout since TD-SCDMA's commercialization is still in disparity compared to CDMA2000 and WCDMA. Although they are both interested in the WCDMA technology, considering the Chinese government's vigorous support to TD-SCDMA technology, China Telecom and China Netcom are closely tracking the TD-SCDMA technological development, and actively participate in TD-SCDMA network tests. (Xia Yongjun)



6. Discussion: TD- SCDMA and China's national interest

The schedule to launch 3G has been postponed again and again. Many manufacturers have been too exhausted to speculate the schedule of 3G. Some estimated that the ultimate deadline for 3G will be in the year of 2008, when Beijing Olympic Games will be held. Large volume of communication and roaming at that time will require China to start its 3G service in order to provide convenience to international visitors. The telecommunications sector is most likely to implement de jure standards (legitimate, just or imposed as a matter of law) due to government ownership of the communications infrastructure. In the 3G decision and selection in China, the government is performing the central role to coordinate and balance the various interests. The ultimate decision power lies in the top officials definitely, and it all depends on the government to balance interest in many different groups, including investment, technology, market, standard, etc, in order to establish technical compatibility and avoid unnecessary welfare loss, according to Paul's theory. In the discussion section, I am going to illustrate the government role in the process of assorting with different players for 3G decision and selection.

6.1 Government and TD-SCDMA:

MII also highlights the importance of TD-SCDMA for their future plans. Apparently, the argument from MII for waiting is to ensure that the technology is ready and commercially operable, for all the three standards. But according to standards economics, it is obvious that the government intervention in standards setting has deliberated political implication. Government hopes to change the monopoly of foreign standards in the era of

3G by supporting domestic development of 3G standards. Since China used the foreign standards and technology for 1G and 2G, and had to pay large amount of patent fees. The Chinese government encourages native 3G technology application to reduce its technical dependence on Qualcomm. Since China's 3G market is potentially worth 1000 billion RMB, without any doubt, the government will not surrender all of the huge profit to the other countries. Chinese are developing technical standard diligently, and hope to reduce the patent fees paid to the foreign corporations, and wish to occupy a small pocket in the international arena of technology. If TD-SCDMA proves to be a feasible technology for commercial application, a huge Chinese mobile market will create a new growth point for China. More importantly, if TD-SCDMA dominates the Chinese mobile market, one that covers almost a quarter of the world's population, it is quite possible that TD-SCDMA will be diffused into other economies, although the most ambitious image seems impossible. Because of its great interest in the standard of TD-SCDMA, the government has given tremendous support to the development and alliance of TD-SCDMA. It is supported by infant theory that, if the TD-SCDMA survives, the protection from foreign competition would result in generating positive learning and spillover effects, therefore stimulating domestic production and encourage more positive effects. As has been pointed out by Paul, the highest priority of standards setting is the interoperability of the technology theoretically, so the Chinese government will have to wait for the TD-SCDMA technology to be more "interoperable" in order to adopt it as a standard, otherwise a indecent technology will cause unnecessary welfare loss for the industry or country.

6.2 Government and Foreign Manufacturers:

Foreign manufacturers are regarded the most active propellant in China's 3G schedule, because they are eager to compensate for difficult times in other global markets. China is one of the fastest growing telecoms markets and largest mobile market in the world; even with a slight slice of the market cake, the absolute quantity may be attractive. Foreign manufacturers including Nokia, Motorola and Qualcomm will become the direct and instant beneficiary in the value chain of 3G business. Because of their strong influence in the industry and their abundant financial resource, they are actively lobbying the China government in order to promote their own technology. However, as we know, in the selection of a technical standard, standards do not flow "neutrally" from the best engineering practice, but rather reflect the full range of strategic behaviors. Both WCDMA and CDMA2000 are more mature and advanced than TD-SCDMA, but what the government cares also includes user welfare and domestic producers. The government has to weigh the promotion of an advanced standard against the demise of a domestic producer, or other perceived national interests. Concerning the large potential market of the country, it seems that the government will not make a festinate decision to launch 3G standard only according to technology superiority. Many other factors are worth considering, including politics, domestic industry and national welfare. On the one hand, the government is enduring pressure from the US government to adopt CDMA2000, since it has been a trading condition for China's accession to WTO. On the other hand, it has been also recognized that WCDMA is a most feasible choice because there is a large installed base of GSM in China, which means a natural and compatible route of transformation. Finally, the government is making every effort to cultivate the TD-SCDMA technology, in order to avoid being squeezed out from the competition, since China's ultimate goal is to transfer welfare to national consumers through the introduction of domestic standard. In general, the interaction between governments and foreign manufacturers is characterized by two levels: aggressively pushing by foreign manufacturers, cautiously weighing by the government in order to balance the different sponsors behind.

6.3 Government and operators:

The telecoms operators in the meantime, they all have their own particular interests in the market although there are still considerable expanding spaces in their 2G market. Having always been excluded from the lucrative and faster growing mobile sector, the other two operators China Telecom and China Netcom have looked jealously over the fence to mobile market and consistently argued that they should also be allowed in cake sharing. In the process to promote 3G, both China Mobile and China Unicom seem unhurried. The continuously increasing mobile subscribers demonstrate that China's GSM mobile market has not saturated yet. China has adequate argument to focus on its 2G market. From this point of view, Chinese operators are less hurried than manufacturers. Neither China Mobile or China Unicom have the great pressure as manufacturers to start 3G, due to the immense potential user source from Western China, where the penetration of mobile is still very low. In addition, they have more privilege in charging policy, since in China subscribers have to pay dual-direction for voice communication, both receiving and calling mobile. These advantages keep Chinese operators the most profitable in all Chinese industries---in recent years, surveys and investigations show that employees in telecommunications enjoy the best pay in China, which is higher by at least 20%. On the other hand, they also get pressure from the government to partially adopt modest TD-SCDMA coverage. But the outcome of such intervention could not to be forecast. As Paul has asserted, there is no possibility of attaining higher social welfare by intervening in the process to mandate standards. Because an imposed standard cannot make sure a general increase of the national welfare although it could possibly increase its market share. In addition, if a less advanced technology was adopted as a standard, it could create large amount of welfare loss for customers and industry: for instance, a less interoperable technology will make trouble in phone call connecting and roaming; a less compatible technology will cause additional investment in infrastructure construction. As Paul points out, it is difficult to ascertain any social opportunity costs locking in any particular mandate standard. But the other two small operators are eager to start 3G and they are enriching the lobby force to promote 3G. As is generally agreed, fix line telephony will eventually be replaced by mobile service, and these two operators have observed the trend and actively switch their own business from fixed line to mobile service—the launching of 3G will be a great opportunity to them, WCDMA, CDMA2000 or TD-SCDMA.

6.4 Government and domestic manufacturer:

Domestic manufacturers have joined the foreign manufacturers' camp to actively promote the launching of 3G. Actually, the domestic manufacturers here only refer to terminal factories. Other domestic manufacturers have not formed visibly in the value chain of 3G. Because of the saturation of 2G terminals in Chinese market and the dramatically decreasing profit of 2G terminals, domestic terminal manufacturers are aware of the pressure to push 3G. However, it is only a less strong player of interest in this game of balancing of power, until now. Because they do not represent a unique advanced technology as TD-SCDMA does, and they do not have the same formidable influence as the foreign manufacturers.

6.5 Government and customers:

There is no sign indicating that the government has given enough consideration to consumers. The lobby seats are mostly occupied by foreign and domestic manufacturers. Just as Prof. Kan suggests, in the debate of 3G in China, the voice from customers is absent. This situation has been observed by Paul, who said that consumer losses tend to be underestimated while producers' gains will be overestimated. This is partly because there is no formal financial support for customers to strive for their benefit. However, the debate over 3G without the participation of customers seems meaningless, because customers are the ultimate beneficiary of 3G service and driving force for further business growth.

Prof. Hu considers it as a “national capture”, which means that the government is, captured by vested interest groups, ignoring the real demand and voices from customers. He points out that in a transforming economy, a prominent phenomenon is government captured, which means that the relevant national departments or public policy is affected and captured by the minority vested interest groups. This causes the public policy, public investment and resources to be assigned to these groups advantageously, while sacrificing the entire social benefit and the overall welfare. He criticizes that certain departments or groups frequently take the so-called national interest and national security as an excuse. It results in public policy malfunction, obstacles and monopolized market, while certain public policies are reduced to special or preferential policies for certain departments and special interest groups. His opinion reveals the problem that customers’ interest has been ignored while the government’s attention has been captured by the vested interest groups. It is suggested that the government should pay more attention to customers’ needs while considering various interests, and investigation, survey and research into consumption trend should be conducted.

6.6 Government and market:

It has been argued by Prof. Kan that there is not visible market demand for 3G at this moment. Since there is still expanding space for 2G market, operators are not anxious to launch 3G service. However, from the economic and industrial structure point of view, each new generation of standards will create a new market, thus giving an opportunity for new players to enter the market and become major players in the new generation of systems. The incumbent players in the old market face the challenge of being locked into the legacy systems they have invested in (Sadahiko Kano). Because of the strong influence of the well-developed 2G networks in China, the introduction of a new standard to the market may encounter unexpected difficulties. In addition, the bubbles in 3G European market also frustrate the confidence in Chinese market. In general, the non-positive market situation does not help to convince the government to start 3G.

National Welfare in General

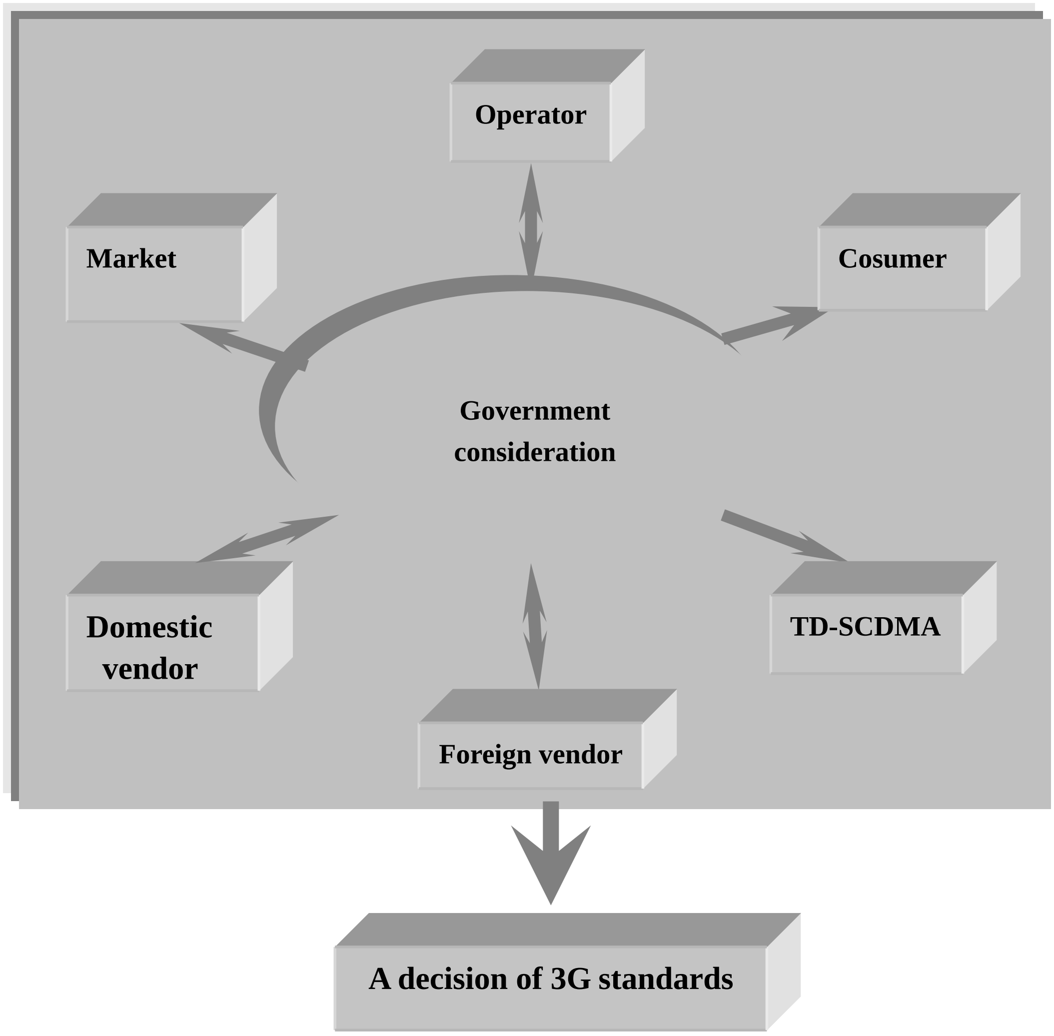


Chart 2: An interactive dynamics between government and other players in China 3G decision

7. Concluding remarks:

Apparently, the 3G debate in China is actually the debate concerning the selection of TD-SCDMA. Will Chinese government follow a technology neutral policy? According to our findings, it is impossible, since the selection of a 3G standard is far from being technology concerned. Some Chinese economists argue that technology is neutral, with no national boundary. Especially in the harsh competition of telecommunication market, the essence is to use a new technology efficiently, regardless of the inventor. However, we do not agree that a technology neutral policy will bring increased welfare. In the case of telecom market, especially such a huge and uneven market, a neutral policy could result in chaos. The most important is the way that the government can play the strategic game of balance of power, with the apparent purpose to increase the national welfare in general. Theoretically, it is well founded and supported. According to List, protection should be based on some condition and period. In the context of the still-evolving national innovation system discussed earlier, the government can be seen to be compensating for weaknesses in its firms, universities, and enterprises by acting as coordinator and guide. Some of the firms participating in government-sponsored standards projects will internalize the process of developing advanced technology and dealing with international standard-setting bodies. This direct participation of Chinese firms in international standard setting demonstrates that the experience of China’s official intervention in this area is part of a larger learning process for firms and for policymakers. To the extent that the firms can develop new technologies of their own, they can become stronger global competitors. As some Chinese companies become technologically sophisticated to pursue their own interests in global standard-setting procedures, the role of government will likely be reduced. Finally the TD-SCDMA's assignment can be fulfilled--the ultimate goal of the deliberate manipulation of 3G standard in the process is to improve China's overall welfare standard in general. Of course, on the one hand, the government will leave a proper portion for TD-SCDMA, on the other hand, the government needs to balance the scale and leave space for the other two technologies because of international and domestic pressures. The selection of standard for different operators will be based on network effect and installed base---China mobile will most probably choose WCDMA because of the natural transformation from GSM, China Unicom will choose CDMA2000 according to its existing CDMA base, and the other small operators will try TD-SCDMA in order to share the cake of 3G. The selection of 3G standards in China is not about the selection of technology superiority, but more about political and economy interests among various groups.

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