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On the relevance of Indigenous Standard Setting Policy: the Case of TD-SCDMA in China

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Abstract. The design and setting of indigenous standard has been a key element of the Chinese Science and Technology policy, in order to lessen the financial burden of foreign IPRs and to develop innovation capabilities. While an indigenous innovation policy is a crucial component of a successful catching-up trajectory, indigenous standard setting is particularly risky because of the specific economic characteristics of standards. Competition between standards is path dependent and subject to increasing returns, which makes indigenous standard difficult to compete with established global standards. In this paper, we analyse and assess the Chinese initiative to develop and launch a domestic mobile 3G standard called TD-SCDMA. Our analysis tends to confirm the predictive prescription of the literature on competition between standards and raises doubts about isolated domestic standard setting policy.

Keywords: China, Telecommunications, Mobile, Standards, Competition, Path Dependence, Increasing Returns, 3G

1. Introduction

China's Science and Technology policy has been characterised by a subtle mix of "open-door" and "self-reliance", adapting over time to the current internal and external conditions.1978 marked a turning point for China's S&T policy, in the context of a transition from a planned and closed economy to a market and open economy. From this year, the Chinese government continuously improved its S&T development policy in order to support its economic development. This policy included supporting R&D through research programs, financing the training of Chinese scientists abroad, and developing the higher education system. A first step of development has been focused on "indigenous production" (see [1], [2]). In the early 1980's, China relied only on imports for the acquisition of telecommunications equipment. Then the government has used its strong hold on procurements of equipment from telecom operators to develop domestic production by subsidiaries of MNE's, JVs between foreign incumbents and Chinese manufacturers, and pure indigenous production [3]. A second step has been characterised by an increasing focus on "indigenous innovation" and has culminated with the formulation of a 15 years Science and Technology plan in 2006, committing China to develop indigenous innovation capabilities and establish position in leading high-technology industries [4]. In particular, the desire to foster the innovation capabilities of the domestic industry and to reduce IPR payment to foreign firms, has led China to develop its own standard setting policies. In this context, more than 20 industries and national standards have been proposed in ICT, such as Caoji VCD, WAPI and TD-SCDMA [5].

The development of domestic innovation, after successive periods of assimilation and improvement is a logical outcome of a successful catching-up trajectory [6]. Having accumulated sufficient knowledge with mature technologies, some industries may be able, with sufficient R&D effort, to repeat the same process with higher-level knowledge in the intermediate technology stage. If successful, some of these industries may eventually accumulate the technological capabilities required to generate emerging technologies and challenge firms in advanced countries. In some cases, latecomer industries can even skip some stages and "leapfrog" to a new technology generation [7].

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However, developing indigenous standards is going a step forward because of the specific economic characteristics of standards. Competition between standards is path dependent and subject to increasing returns, which makes indigenous standard difficult to compete with established global standards. The bulk of research concerning the emergence and adoption of standards originates from the field of economics (e.g. [8]; [9]; [10], [11]). It has outlined the role of increasing returns and path dependence to explain the adoption and dominance of a standard or a new technology. The basic process is (i) that different alternatives are initially in competition, (ii) that one alternative gets an initial advantage (eventually resulting from chance) and (iii) that the dynamics of increasing returns and path dependence lead to the dominance of a standard. [12] have proposed prescriptions for companies involved in "standard wars". First they outline the main critical trade-offs: compatibility versus performance (compatibility with previous technologies is often obtained at the expense of performance), and control versus openness (openness increases the diffusion of a technology but also competition). They indicate that the key assets in standard wars are: control over an installed base of users; intellectual property rights; ability to innovate; first-mover advantages; manufacturing capabilities; strength in complements; and brand name and reputation.

The launch of a third generation of standards on a market on which the previous generation is already diffused is particularly interesting to investigate. On the one hand, it is an occasion to analyse the effect of a generation of standard on the following one. At a global level, for example, it has been shown that the "bandwagon effect" created by the decision of the European Community to adopt a single standard, has resulted in the dominance of GSM and W-CDMA [13]. On the other hand, a new generation of standards may provide opportunities for technological innovation or public policy to disrupt a path dependent process. In this perspective, the case of China exhibits specific characteristics requiring close attention. Firstly, the mere size of the market allows implementing policies which may be illusory in other markets. Secondly, the telecommunications operators are controlled by the state and can be therefore powerful instruments for the Chinese government. In the next section we will present the case study of TD-SCDMA in China, and then follow with a concluding discussion.

2. Case Study

There are currently two main standards for 2G mobile systems. GSM is the most diffused, while CDMA only has a global market share of about 10%. Most GSM operators have adopted the 3G standard that offers some compatibility with GSM networks, W-CDMA (called UMTS in Europe and FOMA in Japan), and most CDMA operators have adopted the 3G evolution called CDMA 2000 [14]. The situation of 2G in China reflects that of the global market with comparable market shares for GSM and CDMA. The natural evolution for Chinese operators would have been to adopt the 3G successors of their current 2G technology, but the Chinese government has decided to take advantage of this switch of generation to support a Chinese 3G standard called TD-SCDMA. TD-SCDMA uses innovative technologies, such as smart antenna and software-defined radio, and allows efficient use of spectrum because the Time Division Duplex (TDD) model only needs a single channel for bi-directional communication. Moreover, this technology, which is particularly efficient in high subscriber density areas, has been designed to provide compatibility with GSM and W-CDMA core networks [15]. It is therefore as easy for GSM operators to roll out a TD-SCDMA network as a W-CDMA network.

TD-SCDMA was accepted by the ITU as a 3G standard in May 2000, and was also accepted in March 2001 by the 3GPP. The standard was developed by the Chinese Academy of Telecommunications Technology (CATT), and its industrial affiliate Datang, in collaboration with Siemens. In December 2000, an industry consortium, the TD-SCDMA forum, was established by China Mobile, China Telecom, China Unicom, Huawei, Motorola, Nortel, and Siemens, to develop and support TD-SCDMA technology. An official support from the government was given in October 2002, by announcing the allocation of significant 3G frequencies to TD-SCDMA (155 MHz), in addition to W-CDMA and CDMA1X to which only 60MHz was allocated. Following this announcement, the TD-SCDMA Industry Alliance was founded by 8 well-known communication corporations including Datang, SOUTEC, Holley, Huawei, LENOVO, ZTE, CEC and China Putian. Several joint-ventures with foreign companies, such as Alcatel, Ericsson, Nokia, Nortel, Philips, Samsung or Siemens have also been created. The Chinese Academy of Telecommunications

Technology (CATT) led the initial outfield test of TD-SCDMA technologies in 2005. The trial results revealed that both network equipment and terminals should be further improved and especially mobile phone chips. Therefore, the government decided to delay the granting of licenses until this technology was ready to be implemented. However, in 2008 the Chinese government authorised the test of TD-SCDMA in 10 cities, which was interpreted as a disguised launch.

In order to prepare the launch of 3G services, a major reorganization of Chinese telecom operators has been conducted in 2008. The principle was to concentrate the market in the hand of three multi-network operators of comparable strength (Table 1) (see [16]; [17] for an analysis of this restructuring).

Table 1: Customer Base of Operators (Q3 2011, in millions) Source: MII

	China Mobile	China Unicom	China Telecom
Standard	GSM TD-SCDMA	GSM W-CDMA	CDMA CDMA2000
2G	590.36	158.8	88.52
3G	43.16	30.23	28.43
Fixed	NA	94.58	170.96
Broadband	NA	54.54	73.69

As can be observed in Table 1, the Chinese government selected the most established operator on the mobile market for TD-SCDMA. The intent was that China Mobile would be able to leverage its vast installed base of 2G customers to diffuse 3G TD-SCDMA services. China Mobile was also the most profitable operator and therefore able to bear the financial risk from the deployment of a new technology. Between 2007 and 2011, China mobile spent CNY 70.58 Billion (about USD 8.7 Billion) to roll out the TD-SCDMA network. China mobile also took several initiatives to develop other elements of the value chain such as chips and handsets. It established a fund to induce handset and chip makers to develop TD-SCDMA products. At the end of 2011, not less than 511 handsets have been proposed with this standard, including famous models such as Samsung Galaxy S2. China Mobile also developed its own Operating System, Open Mobile System (OMS) in 2007, which was developed on the basis of Linux platform, and similar to Android. On August 31, 2009, China Mobile launched its first terminal solution, Ophone, based on OMS. Lenovo was the first to produce a handset for TD-SCDMA, Lenevo01, and a total of 8 handsets were delivered by Dell, Philips, Motorola and so on. China Mobile alleged that the Ophone can match the quality of iPhone and set a high price equal to that of the iPhone.

China Mobile faced increased competition with the iPhone distributed by China Unicom. It first tried to convince Apple to develop a TD-SCDMA version of the iPhone but failed to do it. At the end of 2009, Apple signed a three year contract with China Unicom to distribute the Iphone in China. The launch of iPhone proved to be very successful in China. About 100,000 units of iPhone 4 have been sold within four days after its official launch. More recently, Apple has been obliged to postpone the launch of iPhone 4S because of quasi-riots around its stores. Moreover, iPhone subscribers generate more revenues than other mobile customers (RMB 260 ($40) a month for China Unicom, to compare with an average of RMB 134 ($20) for 3G subscribers and RMB 39.8 ($ 6) for 2G subscribers), 2011, so the best customers of China Mobile tend to switch to China Unicom.

Apparently, TD-SCDMA has a leading position on the 3G market with 43.16 million customers in Q3 2011. However a closer analysis of the available figures shows a less optimistic situation. If we compare this figure with the 590.36 million installed base of 2G customers, it clearly shows that China Mobile is not able to leverage this installed base and convert 2G customers into 3G customers. In comparison, China Unicom and China Telecom, with respectively 158.8 million and 88.52 million of 2G customers, have a much better performance.

As concerns IPRs (Intellectual Property Rights), the situation is also quite mixed. Firstly, the indigenous standard only concerns the air interface, while using the network interface of GSM and W-CDMA. Secondly, the core air interface technology, CDMA, is patented by Qualcomm, while Siemens holds significant patents for TD. Therefore, the share of indigenous patents in the standard should not exceed 30% to 34% [18].

3. Conclusive Discussion

In order to discuss this case we will draw on [12] who have proposed prescriptions for companies involved in “standard wars”. First they outline the main critical trade-offs: compatibility versus performance (compatibility with previous technologies is often obtained at the expense of performance), and control versus openness (openness increases the diffusion of a technology but also competition). They indicate that the key assets in standard wars are: control over an installed base of users; intellectual property rights; ability to innovate; first-mover advantages; manufacturing capabilities; strength in complements; and brand name and reputation.

The strategy of the Chinese government and of the other organisations involved has resulted in the design of a standard that was compatible with the GSM network interface in order to facilitate its adoption by GSM operators. It also aimed at promoting openness in order to build a coalition of organisations supporting this standard, with the creation of the TD-SCDMA forum and TD-SCDMA alliance. China Mobile also induced handset manufacturers and chip makers to produce the necessary complements.

The choice of China Mobile also ensured to rely on a large installed base of customers and benefit from an excellent brand name and reputation. In order to reduce the first-mover advantage of established technologies, the granting of licences has been delayed until TD-SCDMA was fit for launching.

However, the relative failure of TD-SCDMA outlines the difficulty of competing with global established standards supported by a large coalition of powerful players. Firstly, the TD-SCDMA strategy failed to create a coalition of motivated players. The TD-SCDMA Industry Alliance did not operate in a cooperative way and [19], [20]. Moreover China Mobile encountered difficulties in gathering support from handset manufacturers for its own OS, and failed to convince iPhone to adopt the standard.

The standard also does not perform very well and difficulties have been encountered in industrialising it, resulting in longer delays of implementation. The global standards effectively benefited from first mover advantages, as they were at a more mature, industrialised stage.

For these reasons, China Mobile failed to leverage its installed base of customers, as well as its brand name and reputation.

The analysis of this specific case tends to confirm doubts raised about the relevance of indigenous standard innovation [5], [18]. It may be more profitable to participate to the design of global standards, with a small share of IPRs on standards with a large diffusion. However, the knowledge generated during the design and implementation of a standard may be a crucial step in a catching up process in order to be able to play a role in the elaboration of global standards [14].

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