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Comparison of Chinese and Korean companies in ICT global standardization: Essential patent analysis

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ABSTRACT

The latecomers from Asia—China and Korea—started to participate in information and communication technology (ICT) global standardizations as they accumulated technological capabilities. We observed the current situation of ICT global standardizations in those countries by analyzing the mobile communications standards, WCDMA and LTE, and derived interesting findings and meaningful implications from the analysis. First, this paper provides evidence of the differences in Chinese and Korean standard strategies; China is creating its own standard whereas Korea goes with global standardization. Second, this paper shows the subsequent results of the different strategies. In detail, we conducted an analysis based on (declared) essential patents in WCDMA and LTE. The results indicate that China and Korea hold a significant number of essential patents and their numbers compete with those of leading countries. However, the analysis shows that Korea accumulated domestic knowledge that enables the country to actively participate in standardization,but China still heavily relies on foreign knowledge, probably because China is attempting to create its own standard and accumulating knowledge takes a long time despite its efforts.Our findings have several implications for leading countries and other following countries.

1. Introduction

Technological catch-up in Asian developing countries, particularly Northeast Asian countries, has become visible in many areas. For example, scientific catch-up by China, Korea, and Taiwan was observed in the solar cell industry (Sakata & Sasaki, 2013). These countries compete against leading countries such as Germany, Japan, and the U.S. in emerging technology fields and learn from them in matured technology fields. Chinese efforts to catch up in the chemical, medical, and drug industries were also observed (Motohashi, 2008). An analysis of the Chinese patent database showed that a significant number of patent applications to the State Intellectual Property Office, i.e., the Chinese patent office, for chemical, medical, and drug industries were applied from within China: 50% for chemical technologies and slightly more than 60% for medical and drug technologies. Along with other industries, China's and Korea's catch-up in the information and communication technology (ICT) industry is also acknowledged (Fan, 2006; Gao & Liu, 2012; Kenny, Breznitz, & Murphree, 2013; Murphree & Breznitz, 2013; Lee & Han, 2002; Lee & Lim, 2001; Mu & Lee, 2005).

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When a developing country sets a plan for catch-up, another problem besides the technological factor is the market development and growth. If the country has large internal markets, then the external markets may not be of primary interest. If not, the external markets are inevitably of primary interest. Since such a market issue exists in China and Korea, it is practical to assume that China and Korea experience different paths in their catch-up.

The research question of this study is how China's and Korea's standard strategies and their subsequent performances differ from each other in their catch-up approach. This study is aimed to answer the question with an empirical analysis.

The prior studies about China's and Korea's catch-up in the ICT industry fail to discuss how their participation in global standardization is positioned in their catch-up strategy. In addition, no study compared the differences between the national standardization strategies of China and Korea, except Lee and Oh (2008) and Lee and Huh (2012). Lee and Oh (2008) compared China's attempt to set WLAN Authentication and Privacy Infrastructure (WAPI) and Korea's attempt to set Wireless Internet Platform for Interoperability (WIPI) in terms of the role of government, characteristics of each standard, and the process of standards setting. Lee and Huh (2012) conducted analyses on Korea's past efforts to internationalize WIPI and Wireless Broadband (WiBro) and compared with China's cases. But, both papers lack empirical work. In addition, both papers did not find the linkage between the catch-up theory and the mobile global standardization of China and Korea.

When one discusses catch-up in an industry in which the network effect prevails, one must not forget that the standard plays a key role for innovation in the industry (Shapiro & Varian, 1999; Tassey, 2000). Because a standard is considered a technological base in the ICT industry, industry-wide market formation largely depends on the standard. Hence, even if a new entrant gained as much technological capability as that of a leading firm, whether the entrant is capable of leading the industry without leverage over the standard is uncertain. As mentioned above, this paper shows how China's and Korea's standard strategies and their subsequent performances differ from each other. For the analysis, we focus on the cases of Wideband CDMA (WCDMA) and Long Term Evolution (LTE), two of the most successful global standards in the mobile communications industry. Although our scope is limited to these standards, our study achieves an in-depth analysis.

The structure of this paper is as follows. Section 2 reviews the historical background of the standard development of mobile communications in Korea and China, before their activities in ICT global standardization, to see how these countries developed their technological capabilities. Section 3 explains the research data. Section 4 presents our data analyses and findings. Section 5 discusses our findings. Section 6 concludes with remarks on the policy implications and the limitations of this study.

2. Before the Asian rise in ICT global standardization: How China and Korea gained their technological capabilities

We briefly review the history of how Korea and China obtained the technological capabilities necessary to actively participate in ICT global standardization activities. As studies indicated (He, Lim, & Wong, 2006; Jaffe, Trajtenberg, & Henderson, 1993), knowledge transfer played a key role in closing the gap between leading companies and Chinese and Korean companies in the industry.

2.1. Case of Korea

The rise of Korea in ICT global standardization started in the 1980s (Jho, 2007; Lee & Han, 2002). Mobile communications services in Korea were launched in March 1984 through the founding of Korea Mobile Telecommunications Services Co. under the Korea Electricity and Telecommunication Corp. However, the domestic mobile communications industry in the 1980s was heavily dependent on foreign firms: the mobile communications standard adopted was Advanced Mobile Phone System (AMPS), an analog mobile communication standard developed by Bell Labs, and necessary equipment was imported from abroad.

Demand for mobile communications services rapidly grew in the 1990s. To meet the demand, mobile communications evolved from an analog to a digital system. In adopting a digital mobile communication standard, two options led by two different ministries under the Korean government were available.

The first option, proposed by the Ministry of Commerce, Industry and Energy (MOIE, now the Ministry of Trade, Industry and Energy) was the Global System for Mobile Communications (GSM) project. Because GSM was already deployed as the European-wide mobile communications standard in the 1980s, the stability of the GSM system was guaranteed and quick deployment in the Korean market was expected. Because technological capability was inadequate for developing a mobile communications protocol in Korea in the early 1990s, government officers and engineers sought partners. However, no incumbent GSM manufacturer agreed to transfer technology to develop the GSM system in Korea (Yoo, Lyytinen, & Yang, 2005), which meant full reliance on foreign technology. No technology transfer was critical in the Korean government's decision to decline the GSM project because of its belief that technology transfer was important for the growth of the country's technological competence. The Korean government learned the importance of knowledge transfer for national growth from its experience with the TDX development project. In January 1982, was launched the TDX development project at the Electronics and Telecommunication Research Institute (ETRI) with four domestic firms as manufacturers and suppliers of TDX switching equipment: Daewoo, Goldstar (now LG), Otelco, and Samsung. Each firm had international partner(s), that is, advisor(s), such as Alcatel, AT&T, and Ericsson (Chapuis & Joel, 2003; Larson, 1995).

The second option was proposed by the Ministry of Information and Communications (MIC), which advocated the Code Division Multiple Access (CDMA)-based technology by Qualcomm. Qualcomm offered full support to the Korean government's request for technology transfer, including access to Qualcomm's intellectual property and expertise