Korea's strategies for mobile technology standards in smart ecosystem

Jeong Ho Kwak

Department of Business Administration,
Hoseo University,
Cheonan-si, 336-795, South Korea
Email: jhkwak@hoseo.edu

Jemin Justin Lee

Department of Technology and Business Administration,
Yonsei University,
Seoul, 120-749, South Korea
Email: justin.lee@yonsei.ac.kr

Bong Gyou Lee*

Graduate School of Information,
Yonsei University,
Seoul, 120-749, South Korea
Email: bglee@yonsei.ac.kr
*Corresponding author

Abstract: Prior to the introduction of smartphones, South Korea's mobile market had already recognised the early construction of 3.5G technology HSDPA, WiBro, commercial networks, and advanced networks as an important strategy to gain competitive advantage over the market. With the emergence of a smart ecosystem, however, the competition over 4G technical standards is considered to be vital for securing the mobile operating systems and collaborations with participants within the ecosystem, such as the alliances between the devices and content providers. Thus, departing from the viewpoint that a mobile carrier-led network is required to make constant investments and improvements to help create a competitive advantage over the market. Hence, this study targets South Korea's mobile market, to analyse the different 4G mobile standard technologies that were simultaneously commercialised for the first time in the world, to examine the mobile carriers' strategies to dominate the 4G technical standards with the introduction of smartphones, and to provide implications derived from the study.

Keywords: smartphone; 4G; FDD-LTE; WiBro; WiFi mobile technical standards.

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Biographical notes: Jeong Ho Kwak is a Professor at Department of Global Entrepreneurship in Hoseo University. He received his PhD in Information Systems at Yonsei University. He received his BA and MA from Sogang University. His current focus is on developing sector-specific competition policy, start-up in the new ICT industry. He served as a Director of the Industry policy division in KICI.

Jemin Justin Lee is a graduate student at the Department of Technology and Business Administration at Yonsei University. He received his BA in 2013 from Glion Institute of Higher Education.

Bong Gyou Lee is a Dean and Professor at Graduate School of Information of Yonsei University and has served as a Director of Communications Policy Research Center (CPRC) in Yonsei University. He received his BA from the Department of Economics at Yonsei University and an MS and PhD from Cornell University. During 2007 and 2008, he served as Commissioner of the Korea Communications Commission.

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1 Introduction

With the introduction of the smart ecosystem, South Korea's mobile market witnessed the competition over the 4G technical standards and FDD-LTE method-led technical standard take root. South Korea's mobile market have believed that the early deployment of the 3.5G technology HSDPA, WiBRO commercial networks, and mobile services as essential investments to secure the market. Identifying and analysing the deployment of mobile-carrier-led networks and the patterns of the competition over 4G technical standards will help provide a scope over the alliances between the devices and content providers, and other collaboration efforts amongst the participants within the ecosystem.

In the process of competing over the 4G technical standards, South Korea's mobile market rapidly grew with the introduction of smartphones. South Korea is the world's only nation to commercialise both the LTE and WiBro simultaneously in the evolution of 4G technical standards. Thus, presenting itself as an exceptional case that could be used to forecast the mobile technical standards. As such, targeting South Korea's mobile market where different 4G mobile technical standards were simultaneously commercialised for the first time in the world will provide valuable implications for other nations and companies adopting the 4G mobile technical standards.

2 Review of literature

2.1 Overview of smartphone markets

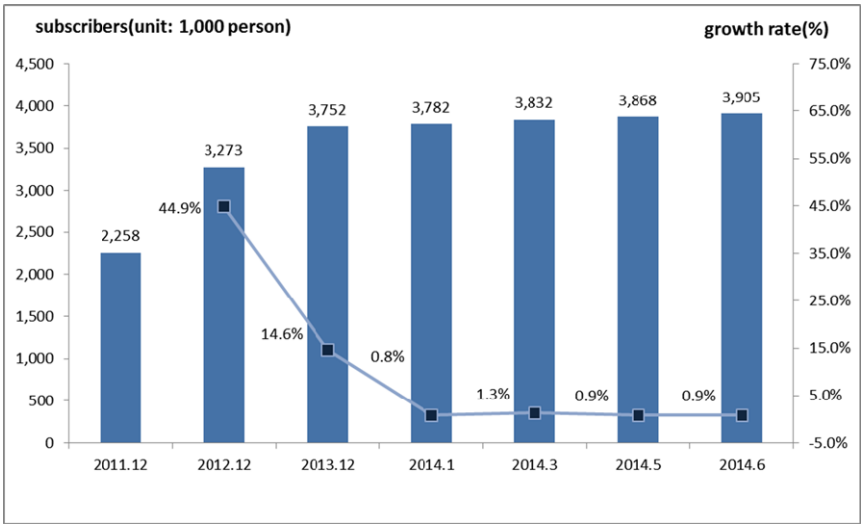
Smartphones refer to mobile phones with advanced functionality by embedding a mobile platform. The mobile platform, which is similar to the PC's operating system, defines the

software platform that efficiently manages and drives smartphone components that includes the hardware's mechanical components such as the memory, LCD and CPU (Jegal, 2010).

Currently, the competition in South Korea's mobile market is focused on the smartphones. As of June 2014, the number of mobile subscribers of the mobile carrier is 28.01 million for SK Telecom (SKT), 17.56 million for Korea Telecom (KT), and 11 million for LG Uplus Corp (LGU+). The rate and number of smartphone subscribers by operator are as follows: 42.7% (24.14 million) for SKT, 29.6% (16.77 million) for KT and 13.8% (7.81 million) for LGU+ (Figure 1).

With regards to South Korea's smartphone penetration by the OS, the early smartphone diffusion stage saw a high peak of iPhone IOS penetration rate; with the activated diffusion of smartphones mounted with Android OS, however, the Android penetration rate was highest at 91.7% as of July 2013, with Apple's IOS recording 7.4% and other OS posting a minimal figure.

Figure 1 South Korea's smartphone subscribers (see online version for colours)



2.2 Competitive strategy for technical standards

2.2.1 Overseas cases

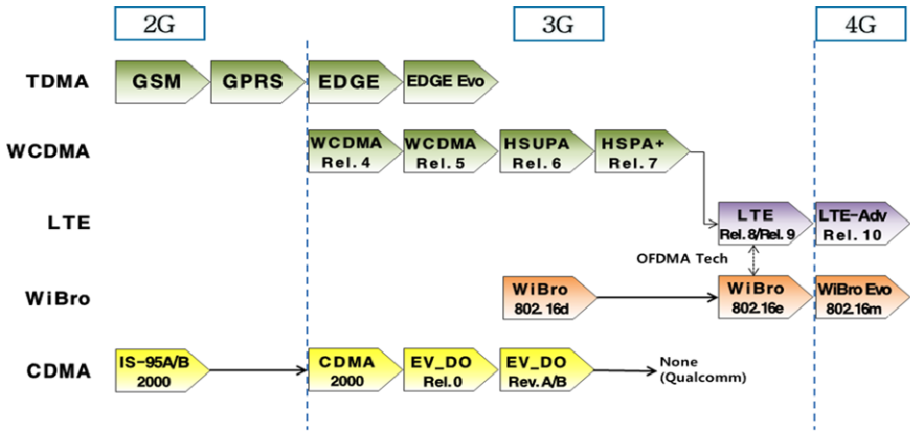
Mobile services with voice communication was commercialised in the year 1981, which was the first-generation analogue-type (AMPS, NMT) mobile technology. With the emergence of the second-generation digital mobile technology, the competition barriers for the standardisation of technology became more challenging. Mobile technology – which is classified into the Qualcomm-led American method (synchronous system) and the Nokia-led European method (asynchronous system) – is fiercely competing for adoption as the international standard and as the standard in individual nations, and is continually evolving. The third-generation mobile technology focused on high-speed internet, video telephony compatible, and mobile technology enabling broadband internet (100 M–1 Gbps) and multimedia services. Moreover, the mobile technical standards amid

fierce competition for standardisation of the fourth-generation technology have allowed the mobile technology to quickly evolve.

With the abandonment of the development of the American-type ultra mobile broadband (UMB), the fourth-generation mobile technology is being led by the long-term evolution (LTE) method. In the case of WiBro, which was developed in 2006 under the leadership of Samsung Electronics and Intel, the WiBro evolution, which evolved into the fourth-generation technology, was adopted as an international standard in 2012; however, it nonetheless lags behind the global trend in terms of adoption as a standard mobile technology by individual nations (Figure 2).

Recently, to secure the leadership in the standardisation of fifth-generation mobile technology, nations around the world have been competitively investing in fifth-generation technology R&D from the initial stage, based on the government-private sector collaboration. Also, to commercialise 5G, competitive efforts are being made to secure broadband frequencies, as well as to establish and implement policies for research support, technology standardisation, and the commercialisation of services (Table 1).

Figure 2 Mobile technology evolution (see online version for colours)



2.2.2 Overseas cases

Many research studies on mobile technology evolution in the markets were conducted in diverse fields. In particular, many research studies on 3G mobile technology's evolution direction were conducted (Yoo et al., 2005; Lee, 2005). Park and Chang (2004) used a techno-economic model, which evaluated the strategy from 2G to 3G evolution in South Korea, and explained the validity of the adoption of WCDMA. Dahlman and Parkvall (2003) presented the future development direction for 3GPP WCDMA evolution. Chung (2002) researched on 4G mobile's evolution direction according to the future mobile sociocultural changes and consequently analysed the corresponding economic and social ripple effects. Lehr and McKnight (2003) assumed that different standards (3G, WiFi) had mutually competitive and complementary relations in the stage of broadband wireless access evolution and performed a qualitative analysis of the future evolution process. Yoo et al. (2005) used actor network theory (ANT), analysed the 2G to 3G technical standards evolution process, and claimed that standardisation played an important role in determining the relations between actors. Lee et al. (2009) analysed South Korea's 3.5G

technical standards evolution and consequently identified the strengths and weaknesses of WiBro and HSDPA technology evolution and presented important competitive factors in the technology evolution process.

Table 1 Mobile research trends in major nations

Category	*Outline*
China	The government (Ministry of Industry and Information Technology) is leading the formulation of technology/standardization/frequency strategies
Japan	Universities, corporations and research institutes conduct R&D individually in preparation for 5G
Europe	5G research foundations have been established and large-scale projects are being conducted to perform the relevant fundamental research
	During the period 2014–2020, KRW 2.4 trillion (EUR 160 million) will be invested (EU-private sector investment rate, 5 : 5)
UK	A large-scale project is being conducted with the participation of numerous private companies with Surrey University as the hub
	Launched in August 2012 with an investment of KRW 70 billion
US	Private sector and academia are leading the research on 5G source technology

Source: Oh (2014)

These existing research studies mostly concern the comparison of technical superiority in the technology evolution process and the analysis of viewpoints on network upgrading before the adoption of 4G technology standards. Nonetheless, they fail to analyse systematically the competitive strategy for mobile technical standards following the emergence of a smart ecosystem.

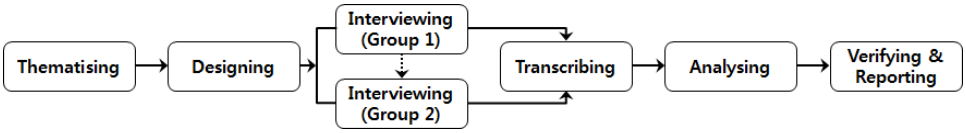
3 Standardisation evolution strategy in mobile markets: 4G technology standards

3.1 Analytical model

This study involved two stages of research including a Delphi-technique-based survey and in-depth interviews of experts in the mobile industry, academia, and research circles, and consequently gathered industrial policy data concerning competitive strategies for mobile technical standards following the emergence of the smart ecosystem. The Delphi technique is a method by which closely planned questions are repeatedly asked to derive agreement among a group's members, and by which relevant opinions are forecasted based on an analysis of the average and mean of the results gathered from the repeated questions. As such, the Delphi technique is a qualitative methodology by which an uncertain future environment in the social science field can be obtained based on experts' opinions. It is commonly used as a brainstorming method of gathering experts' opinions to forecast the future and to explore policy alternatives, but it involves repetition, feedback, anonymity and agreement among other procedures, thereby differentiating it from brainstorming (Kvale, 1996). In addition, the in-depth interview, which is widely used in qualitative research, enables interviewers to adjust the order and contents of questions and to ask in-depth questions for their convenience. From 4 August to 5

September, 2014, the in-depth interviews were conducted with 20 mobile experts from ETRI, KISDI, KAIT and three mobile carriers. Likewise, a survey was conducted on the mobile carriers' competitive strategies, the government's policy on technical standards, the technical strengths and weaknesses, and the effects of the smart ecosystem on technical standards following the emergence of a smart ecosystem. Notably, experts from KISDI and ETRI – state-run research institutes that conduct research on the ICT industry policy – were included as survey targets, thus boosting the reliability of the derived policy direction and implications with regard to the strategy for mobile technical standards evolution (Figure 3).

Figure 3 In-depth interview process



3.2 Analysis results

After the introduction of smartphones, mobile markets' competitive structure has been reorganised to revolve around mobile internet, prompting investments in 4G technology evolution. Specifically, the emergence of a mobile ecosystem triggered a surge in data traffic. Thus, driving the 4G mobile technology evolution. Unlike other nations, South Korea sees the mobile technology evolution experience as a path that is different from conventional ones. The surveys and in-depth interviews revealed that South Korean mobile carriers' competitive strategy for technical standards in the mobile markets – following the emergence of a smart ecosystem – involves the FDD-LTE method dominating the markets with the patterns described below.

3.2.1 FDD-LTE-oriented standardisation strategy: SKT

SKT drove forward the standardisation of both LTE and WiBro, but invested mainly in LTE. As a result, SKT commercialised LTE in July 2011 for the first time in the country. One year later, the company commercialised multi-carrier LTE, commercialised LTE-A in June 2013, and commercialised broadband LTE-A in 2014. In addition, with the unveiling of devices supporting the application of IPV6 to overall mobile internet addresses, the company is pushing to upgrade its networks further to lead the way in innovating the internet of things.

3.2.2 FDD-LTE, WiBro, WiFi integrated net strategy: KT

As the technical strategy for constructing and standardising next-generation mobile networks, KT is driving forward the 4G technologies of LTE and WiBro simultaneously and pursuing the strategy of constructing integrated networks in large cities' densely populated areas to complement mobile services through WiFi. Nonetheless, KT is struggling as a latecomer in upgrading LTE networks and commercialising services, as the company faces a fierce competition in mobile markets nowadays. Seeking to secure competitive advantage over its competitors, KT won a bid to obtain the D2 block

(1.8 GHz, 15 MHz), LTE frequency's neighbourhood band; thus enabling it to secure a foothold for broadband LTE services.

3.2.3 FDD-LTE exclusive technology standardisation strategy: LGU

LGU+ shifted directions in constructing 4G mobile networks from the existing CDMA-based technology evolution to GSM-based LTE and made the corresponding investments as Qualcomm waived UMB. To recover from its 3G sector setback, the company became the first among the mobile carriers to construct the FDD-LTE network nationwide. Moreover, in July 2014, LGU+ constructed broadband (80 MHz, which is broader than those of other carriers) LTE networks in 84 cities nationwide, focusing on technical and quality competition.

3.2.4 Wibro-oriented standardisation strategy: KMI and IST consortium

KMI and IST plan to enter the markets as the fourth carrier to provide voice communication (mVoIP) via mobile phone using wireless internet and wireless internet networks. Unlike KT and SKT which provide WiBro services, this strategy is designed to allow the user to use not only wireless internet, but also voice communication via WiBro.

3.2.5 LTE-TDD-oriented standardisation strategy: potential 4th mobile carrier

With China's China Mobile recently commercialising TDD-LTE as technical standards, South Korea's potential fourth carriers are paying attention to the mobile critical mass and pushing to acquire business permit for the TDD-LTE method. In this regard, in February 2014, KMI sought to obtain business permit for 4G based not on WiBro technical standards but on TDD-LTE technical standards. According to OVUM (2014), 2016 will see the number of TDD-LTE subscribers account for 25% of the total LTE subscribers; this figure reflects the potential growth of Chinese markets that have adopted TDD-LTE as the major technical standards.

4 Conclusion and implications

Targeting South Korean mobile markets that simultaneously commercialised different 4G mobile standard technologies for the first time in the world, this study examined the mobile carriers' technical standards strategy for dominating 4G technical standards in connection with the introduction of smartphones to the markets. Thus, this study drew the following implications with regard to the effects of the evolution of mobile technical standards on mobile carriers' business strategy and the government's policy direction, following the introduction of smartphones:

First, as with the introduction of a smart ecosystem, the industrial structure of mobile markets is shifting from a local market to a global one. South Korea sees the influence of global standards – a market factor – becoming stronger than the government's policy factor in the process of evolution of mobile technical standards.

Secondly, in a smart ecosystem, in case a nation drives forward a technical standards strategy, if the corresponding policy fails to accurately reflect the market situation, the carriers may be forced to drop out of the markets even though they have secured the standards. South Korea pushed for the fostering of WiBro, as the 4G national mobile standards. But failed to respond in a timely manner to the markets' policy issues, including the permission of voice communication in the initial stage, duplicated investment problems, limited coverage and erosion of self-markets; thus losing the competition with the FDD-LTE method, despite being the world's first to commercialise it as well as its technical competitive advantage.

Thirdly, with the emergence of a smart ecosystem, even after the competitive advantage of global technical standards is determined, if it is possible to secure a stable critical mass, new technical standards can be driven forward. South Korea forecast that, in the 4G technical standards evolution, after the competitive advantage of FDD-LTE was secured, WiBro and all other technical standards would all decline. After China Mobile adopted the TDD-LTE method, however, KMI and other new carriers are pushing to adopt TDD-LTE as technical standards.

Based on the unique Korean market situation wherein different technical standards – commercialised for the first time in the world – are competing, this study analysed and compared the evolution process of various 4G mobile technologies after the emergence of a smart ecosystem. Such Korean cases are expected to serve as important lessons for nations or business operators intending to introduce 4G mobile technical standards under a smart ecosystem.

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