論 文 の 内 容 の 要 旨

論文題目　Patents in Standards and Innovation: An Empirical Study on Dynamics of Essential Patents in Mobile Communications Standards
(標準特許とイノベーション:移動通信標準における標準特許のダイナミクスに関する実証研究)

氏　名　姜 秉祐

Both patent systems and standards are aimed to encourage innovation. The patent system grants exclusive rights over the inventions that one invents, and granting the exclusive rights by the patent system is aimed to motivate an inventor to invent and collect monetary rewards from the inventions by commercializing them. A standard is a preparation to form a market and to compete. Standardization, a process to develop a standard, is a voluntary cooperative process to create a consensus-based base so that innovation can be achieved.

However, questions have been raised when technologies necessary to use a standard are protected by patents. Those patents are called essential patents. Essential patents attract much attention because of their unique nature. Essential patents are patents and also a part of (technical) standards. Thus, essential patents have characteristics that patents and standards have. When technologies necessary to use a standard are protected by patents, one has to pay license fee to the owner(s) of the patents. Thus, the owner has exclusive rights over the standards through his inventions. Recent years, we observe a licensee pays billions of dollars to a licensor

to reach a license agreement. The most recent case as of today happened in September 2013. Microsoft announced to pay 3.79 billion euros for Nokia's handset business and 1.65 billion euros for a 10-year license for Nokia's patents. Nokia decided to hang on to its patents. Although Nokia does not reveal specific targets, many believe that Nokia will go after other manufacturers for royalties. Thus, giant lawsuits will be followed.

Based on the background above, this thesis is inspired by a question, 'Do patents in standards encourage innovation.' The question is the one underlain throughout this thesis. However, this question is too broad. The discussion is ongoing in various points of view, and it is impossible to answer the question from all the existing points of view in this study. Thus, I narrow down the discussion by aiming at understanding the dynamics of patents in standards. Specifically, I will try to answer from two points of view with in depth analyses.

Question 1: How do firms obtain patents in standards in standardization?
Question 2: What are the afterward benefits of having patents in standards?

The first finding is firms' efforts to obtain essential patents. Obtaining essential patents is important for innovation competition in the network industry, where technical standardization plays a critical role in development. I empirically investigated the determinants of essential patents for wireless communications standards by using the patent database. More specifically, I used the technological capabilities of both the firm and the patent inventor to explain the probability of its selection as an essential patent. In addition, I compared manufacturing firms' and non-practicing entities' (NPEs) technology strategies for essential patents. Our results indicate that manufacturing firms accumulate their technological capability in specific technology fields, whereas NPEs cover broader technology fields to keep their dominant position in the standardization process.

The second finding presented an in-depth investigation on the standardization process of the successful Wideband-Code Division Multiple Access (W-CDMA) and Long Term Evolution (LTE) standards for mobile telecommunications. I studied the first 77 meetings where these standards took shape, covering a period of over 12 years, and identified the patenting behavior of each of the 939 individual participants attending these meetings, as well as the

patenting behavior by non-participants, together resulting in over 14,000 patents for this technology. The data revealed a strong relationship between patent timing and the occurrence of meetings. I observed a remarkable phenomenon that I call 'just-in-time-inventions': the patent intensity of about-to-become claimed essential patents is much higher during or just before these meetings than in other periods. At the same time, they were of considerably lower technical value ('merit'). This suggested that the just-in-time inventions are only beneficial to their owners, whereas for the public they merely invoke unnecessary costs. Finally, I observed that the phenomenon of just-in-time inventions is highly concentrated among specific types of firms, above all vertically integrated ones, and the incumbent champions of the previous technology standard.

The third analysis investigated empirically how essential patents play a role as a knowledge source for future R&D. The firms owning essential patents were classified by their business models, and it was investigated how significantly each business model manages the technical standards for their R&D activities by comparing knowledge sources. The results indicate that there is significant difference among different business models in utilizing each knowledge source for their R&D activities. NPEs conducted R&D based on technical standards. Chipset vendors actively conducted R&D based on technical standards. Manufacturers conducted R&D based on their internal knowledge. However, manufacturers from China and Korea are less likely conduct R&D based on their internal knowledge.

The last part identified that the list of WCDMA and LTE essential patents, and found other information by matching the list to patent database. From the analysis, I found that Asian countries occupy a significant proportion of essential patents. In terms of the number of essential patents, Asian countries compete against leading countries. At the same time, the analysis of essential patents showed that their efforts to develop a standard originate more from domestic knowledge, and their dependence on the knowledge of leading countries is decreasing. However, I also found that there is still a gap between leading countries, especially U.S., and Asian countries. Chinese and Korean contribution to standardization in terms of technological value is still small. This describes some limitation in Chinese and Korean efforts. However, under some condition, their contribution was non-negligible compared to that of the leading countries, which provides a hint where and how China and Korea as well as other Asian countries

must proceed from now on.

Taken together, I conclude that essential patents have a limitation to push innovation. The phenomena are resulted thanks to the legal powerfulness of the essential patents. As a result, firms pay too much interest in essential patents. Essential patents provide owners exclusive ownership in the public property. The exclusive ownership in the public property increases unnecessary social costs and blocks fair competition. Thus, fair, reasonable, and non-discriminatory (FRAND) terms for essential patents must be respected so as to lessen the exclusive ownership in the public property. In addition, we need a third party which can evaluate claimed essential patents and filter out unsuitable essential patents. One may propose essential patent pooling, but pooling the essential patents is not enough because concerns will be raised who to lead, how to allocate licensing revenue, etc. More study is necessary. Finally, standardization must work not only as a place to 'negotiate' the standard but also as a forum to exchange information between firms because standardization provides opportunities to combine distributed knowledge, to lessen risks, to form a market, and to direct development.