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Intellectual property portfolio as a key strategic tool for technology seeker

-Along with Appropriability Regimes and Complementary Assets-

기술수색자의 중요한 전략적 도구 지식재산 포트폴리오

－전유성 체제 및 보완자산과 함께－

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Abstract

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In the last decade, the number of patent disputes has surged. This indicates an increase in imitation among firms. Due to this trend, finding news on patent disputes is an easy task, especially in terms of smartphone-related news. Multifunctional smartphones—which include features such as DMB(Digital Multimedia Broadcasting), games, radio capabilities, cameras, and e-mail access—are a combination of technologies from various industries. This implies the disruption of industry boundaries, with boundary disruptions causing imitation and imitation causing boundary disruptions. Thus, looking at the increasing number of patent-infringement disputes and cases of

imitation shows the needs for an imitation strategy with a systematic flow based on given circumstances for each firm. In the past, among the scholars solely promoting innovation, David Teece (1986), the author of a popular article “Profiting from Technological Innovation”, selected appropriability, complementary asset, and dominant design as his three building blocks, and Cohen et al.’s (2000) industry types (discrete and complex) and IP (Intellectual Property) portfolio were added as additional building blocks to develop imitation guidelines for technology seekers. A total of 25 cases are studied and 50 firms mentioned in this study. Its most significant finding regards the new uses of IP portfolios. IP portfolios were developed to protect the technology and business of innovators, but now act as an effective tool to moderate the appropriability strength. Teece (1986) defined appropriability with only exogenous factors, but IP portfolios can endogenously strengthen a firm’s appropriability. Moreover, an IP portfolio is the key tool in imitation processes for technology seekers. A relatively strong or competitive IP portfolio gives excellent bargaining power, which can reduce the potential dispute risk and loss.

Keywords: Intellectual property portfolio, complementary asset, appropriability, imitation strategy, patent dispute, industry type

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Chapter 1. Introduction

1.1 Imitation under the Shade of Innovation

Human beings are naturally born with imitative behaviors, mostly concentrated during young age. At this stage, human behaviors typically depend on one's environment. During the learning process of all ages, when a certain cumulated capability is achieved via imitation learning in the past, a human being starts to attempt innovative or creative behavior; however, at same time, imitation behavior co-exists.

Similar to human behavior, a firm—an organization composed of human beings—also goes through imitation processes within their product (or process) development cycles. Every time it develops a new product or process, imitation cannot be neglected as a key strategy. Not every bit of knowledge is stored within a single person or firm in order to develop a product (or process), and external knowledge is thus inevitably needed (Bolton, 1993), in order to be inspired and develop a product (or process). It is for this reason that a countless number of multinational firms such as Ford (the minivan), Microsoft (word-processing software), Pepsi (diet cola), Apple (visual interfaces), Texas Instruments (transistors), Wal-Mart (the barcode), McDonald's (the fast food chain system), and Samsung (semiconductors) have implemented imitation strategies for marketing, products, technology, design,

processes, and so on. along with innovation strategies, and successfully achieved innovative imitation in order to gain profit and grow in their fields (Levitt, 1966; Schnaars, 1994; Shenkar, 2010). However, the importance of imitation is still veiled by the shade of innovation.

1.2 The Rise of the Dishonored Term "Imitation"

Since Schumpeter's 1934 study on innovation, researchers such as Abernathy and Clark (1985); Chesbrough (2003); Garcia and Calantone (2002); Gatignon, Tushman, Smith, and Anderson (2002); Rajagopal (2005); and Tushman and Nadler (1986) have persistently raised their voices to endorse innovation. The eminent scholar David Teece (1986) proposed frameworks and strategies for innovators to profit from innovation, emphasizing appropriability regimes and complementary assets (distribution and manufacturing capabilities). Strategies for imitators corresponding to Teece's strategy have not been developed yet, however. Moreover, many CEOs still focus solely on innovation and neglect the powerful tool of imitation. They believe that focusing on expanding and promoting innovation is the most effective way to expand their profit (Drucker, 2006; Rajagopal, 2005). The attitude toward imitation is highly dishonored and it is treated as a shameful subject to be spoken in the general market and in mass media while sharply criticizing it (Bolton, 1993; Schnaars, 1994). As evidence,

imitators are often scornfully labeled as “cloners,” “pirates,” “copycats,” “counterfeits, and “knockoffs” (Bolton, 1993). One interesting fact, however, is that innovation does not automatically bring profit to the innovator, who is the first to commercialize a new product or process; but rather, as mentioned above, imitators such as Apple, Samsung, and Microsoft, commonly benefit from the technologies created by innovators (Levitt, 1966; Shenkar, 2010; Teece, 1986). Theodore Levitt (1966), the “high priest of innovation,” once said that “We live in a business world that increasingly worships the great tribal god *innovation*,…”, and that there is more imitation than innovation in the world, because the possibilities of innovation within one single firm is limited and the force of competitive circumstance exists in such a way that imitation is carefully used for survival and growth (pg. 65). Since his piece’s 1966 publishing in the *Harvard Business Review*, imitation has begun to gain the attention of many other scholars studying innovation, resource management, intellectual property rights(IPRs), and so on (Garcia & Calantone, 2002; Levitt, 1966; Sadowski & Sadowski-Rasters, 2006; Sandberg, 2007; Schewe, 1996).

In addition to increasing the prevalence of imitation strategies and recognizing their effectiveness, over the last few decades industry boundaries have become increasingly worn down due to the convergence of knowledge in various fields in developing a product (or process) to meet the needs of a given market. For example, the

automobile industry no longer concentrates on mechanical components but rather on electrical components due to “green” movement around the world. The mobile phone, music player, and camera industries are merging with each other and forming a large battleground in the smartphone industry. Due to this change, products (or processes) get more complex such that no product is entirely composed of innovations that are fully developed by one firm or person. A product consisting of several innovations is mostly a combination of in-house innovations and innovations acquired or borrowed via an imitation process (e.g., invent-around, licensing, cross-licensing, and mergers and acquisitions) from others (Bolton, 1993; Teece, 2006). Thus, fully innovative firms or pure innovators are rarely found today. Moreover, the advantage and importance of innovation is overly exaggerated such that sole innovation without imitation is almost impossible and is not the “magic ingredient” for a firm.

1.3 The Rise of Intellectual Property Portfolio (IPP) Importance

As world entered the twenty-first century, the era of the knowledge-based economy has gradually emerged. Countless number of new technologies, designs, methods, and ideas are pouring out from research and development (R&D) centers of firms and institutions

around the world. The major indicator of this phenomenon is the significant increase in the annual growth of patents being filed during the past decade.[1] In the meantime, patent disputes doubled during the 1990s (Espe, 1999) and continue to increase today. The increase in disputes not only implies an increase in the importance and value of patents (Korman, 1998), but also of infringement and imitation.

Protected inventions (e.g., patents, trade secrets, or trademarks) are called *intellectual property*, and a bundle of them is called an *intellectual property portfolio* or a *patent portfolio*. In the past decade, intellectual property portfolios (IPPs), initially created and developed to protect and shield invention and inventors' rights, became the key strategic arsenal for firm survival and growth, as patent-related disputes can suddenly shut down a production line or marketing activity via a court order (Kline, 2000), and can sometimes, considerably determine the fate of a firm. However, an IPP can also be used as a key imitation tool.

1.4 Research Objectives

Observing various cases of high-technology industries showed

[1]WIPO Economics & Statistics Series *World Intellectual Property Indicators 2011* shows that patent and trademark filings worldwide grew by 7.2% and 11.8%, respectively, in 2010 compared to a 5.1% increase in global gross domestic product(GDP), and; that an all-time high of 1.98 million patent applications were filed globally.

general trends that the implications and strategies for an imitation process are derived.

In this study the scope of *industry* is narrowed down to technology-centered industries such as the software, semiconductor, electronics, information technology (IT), biotechnology, and pharmaceutical industries, in which the imitation process is relatively more challenging than in low-technology industries due to the dynamics and complexity of the technologies being used and the recent rise in the gravity of IPRs, and which plays a much more critical role in a technology-centered industry than in a low-technology industry.

Whereas most previous innovation and imitation strategic analyses have highlighted environmental factors and; the level of an appropriability regime as a driver of strategic choice, a framework here suggests that the key driver of successful imitation is IPPs, which endogenously determine an appropriability regime. Existing innovation strategies—focused on the three building blocks of complementary assets, appropriability regimes, and dominant designs—designed by Teece (1986) are revisited in reverse perspective as from an imitator (or technology seeker). While most of the research on IP rights studied only innovator IP rights (Amara, Landry, & Traoré, 2008; Leiponen, 2008), those on imitative firms are still critically lacking, in particular, the strategies for imitative-firm IP management (Huang, Chou, & Lee, 2010). Thus, similar to the structures of frameworks and

commercialization strategies for innovators developed by Teece (1986);Gans and Stern (2003); and He, Lim, and Wong (2006), winning strategies for imitators are proposed to guide the successful imitation of technology and commercialization for when a firm needs to develop a product through not only its own innovation but also through imitation (borrowing or using of others' innovation). Strategies vary in respect to the relative strength of an IPP, the industry type (complex and discrete), and complementary asset accessibility.

Frameworks and strategies are supported by various cases and each compartment of a framework or strategy is explained with a detailed analysis of cases from various technology-centered industries, ranging from the IT (complex) industry to the pharmaceutical (discrete) industry.

The next chapter starts with brief definitions of *imitation*, *innovation*, and *technology seeker* and *holder* in order to clarify the terminologies being used in this study. Teece's (1986) three building blocks will then be revisited from an imitator's point of view, along with an additional block—IPP. Chapter 3 presents in detail recent controversial cases within the smartphone industry. Chapter 4 explains implications and strategies for various cases (25 cases and 50 firms) in terms of complementary asset and appropriability determined by relative strengths in IPPs and industry types. Chapter 5 concludes this thesis with findings, limitations, and notes for further research.

Chapter 2. Theoretical Background and Research Design

2.1 What Is Imitation?

Before stepping into the research design of this research, defining *imitation* seems fundamentally necessary to clarify the scope of this research. Imitation is often held in contempt compare to innovation, and people often confuse *copying* and *imitation*[2]. But interestingly enough, however, is that imitation is more common than the other due to its effectiveness in growth and profit (Levitt, 1966; Schnaars, 1994; Teece, 1986). The noted Austrian economist Joseph Schumpeter (1934) defined *invention*, *innovation*, and *imitation*:

- *Invention* is the purely physical act of creation and discovery.
- *Innovation* is commercialization or use of the invention.
- *Imitation* is the diffusion of innovations.

[2] The term *imitation* used in this study differs from simple copying. Copying is duplicating the exact format and style of original work (e.g. technology), but imitation is absorbing existing knowledge and reproducing it within one's own capability, and a certain level of modification could be included. This is similar to what Picasso said "Good artists copy, but great artist steal" (Shenkar, 2010). Also, imitation here is different from piracy, plagiarism, and forgery (Schnaars, 1994).

Table 1. Types of Imitation and Innovation

Imitation (Schumpeter, 1934) : the use of existing methods and ideas		Innovation (Schumpeter, 1934) : the use of new methods and ideas	
Internal	External	Internal	External
Borrow existing innovation via invent-around (potentially illegal)	Legally borrow existing innovation via licensing contracts	Create innovation via in-house R&D with one's own R&D resources	Create innovation with (a) strategic alliance partner(s)

In this research, the definitions of *invention* and *innovation* are directly followed by the definition in Table 1, above. The definition of *imitation* is defined with a slight modification by rephrasing Schumpeter's: the use of existing methods and ideas. An object being imitated is not always a finished product, such as a me-too product. Imitation also includes the imitation of components within a product, process, or service. If an existing innovation, developed by another, is borrowed via invent-around or a licensing contract, this act is imitation with differences only in the existence of potential legal disputes. Thus, obtaining or accessing technology through licensing-in is also an imitation strategy, as technology is not invented or developed within one firm and technology is borrowed legally from other innovative firm before the borrowing firm replicates the borrowed technology.

2.2 Setup: Technology Seekers and Technology Holders

Most research related to innovation, imitation, and first-mover advantages tends to use terms *innovator and imitator* and *fast mover and follower* to explain players in an industry competition. However, not only imitators or followers imitate—innovators or fast movers imitate as well, as any innovator can be an imitator at anytime due to the disruption of industry boundaries or previous history as an imitator. Instead of *imitator* (follower) and *innovator* (first mover), the terms *technology seeker* and *technology holder* are used, respectively, to describe players in the imitation phenomenon. When a technology seeker accesses a technology holder's technology and imitates it via invent-around or licensing, a product developed by a technology seeker does not only consist of a single technology acquired from outside, but also multiple technologies from internal and external sources. A final product requires various technologies related to a product and a process. In the past decade, the complexity of products has significantly increased, and the industry boundary has been disrupted by the convergence among various fields of multiple technologies necessary to maximize an outcome. Chesbrough (2003) proposed the theory of open innovation, which addresses the importance of sharing internal and external knowledge to create innovation. Firms need to go beyond their own R&D departments and find the best technologies wherever they

exist, combining them into integrated solutions; such combining requires imitating external sources.

The term *technology* used in *technology seeker* and *holder* is not only limited to denotative technology, but also connotatively includes the design, hardware technology, software technology, manufacturing technology, and so on that are needed to produce a product for consumers. However, trade secrets and tacit knowledge are neglected due to the dynamics of strategies.

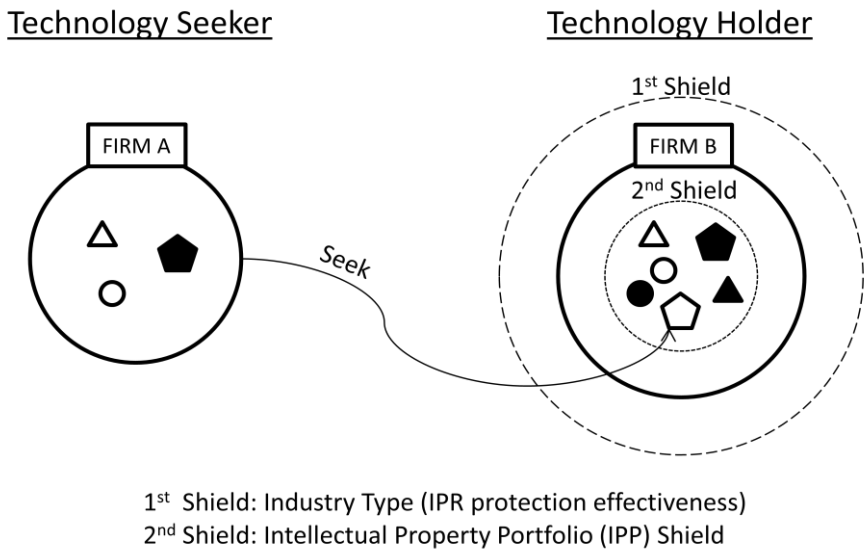

Figure 1. The Imitation Process between a Technology Seeker and a Technology Holder

Figure 1 above is provided to help understand the imitation process. Firm A, a technology seeker, is seeking technology from Firm B, a technology holder. Geometric figures inside Firm A and Firm B represent intellectual properties. In order for a technology seeker to access desired IP, one must penetrate two layers of the shield protecting the technology holder. The first shield is the industry type (discrete or complex) (Cohen, Nelson, & Walsh, 2000), which has a propensity to have different IPR protection effectiveness. The second shield is the IPP shield developed by the technology holder, Firm B. The shields are exogenous and endogenous, respectively. Therefore, these two shields

exogenously and endogenously[3] determine the appropriability regime (weak or strong) of the technology holder.

2.3 Teece' s Three PFI Building Blocks

In 1986, David Teece published an article in *Research Policy* entitled "Profiting from Technological Innovation" (PFI). This article has been cited more than 6,000 times, and it is still being cited by many scholars studying innovation. This study placed an emphasis on complementary assets (e.g., manufacturing and distribution), appropriability regimes, and dominant designs for innovators seeking profit from their innovations. Its message was that the targets of strategy users are technology holders, and that every strategy is focused on and designed for technology holders with respect to the technology seeker's position and actions. However, careful observation and the rephrasing of the building blocks and strategies proposed by Teece is necessary to develop updated and suitable strategies for the current dynamic industrial atmosphere and for technology seekers. The following sections on complementary assets, appropriability regimes and dominant designs are meant to fit technology seekers.

[3] A detailed mechanism of appropriability is explained in 2.3.2 and 2.4 under Chapter 2, and Implication and Imitation Strategies under Chapter 4.

2.3.1 Complementary assets

A complementary asset is the most emphasized building block by Teece (1986) and has inspired many researchers and led to extended research (Gans & Stern, 2003; He et al., 2006; Teece, 2006). According to Teece, a complementary asset is an endogenous factor that provides services such as marketing, competitive manufacturing, and after-sales support. Thus, it determines success in commercialization and profit (Teece, 1986). Specialized assets, as opposed to co-specialized assets, are those in which the innovation and the complementary asset asymmetrically depend on each other such as in distribution channels and any product innovation (Teece, 1986).

Complementary assets are important for innovators as well as for imitators. Teece (1986) also suggested that an approach for imitators to catch up with innovators or first movers is to gain control over superior complementary assets. After a technology is accessed via imitation, a commercialization process should be executed to gain major profit directly from consumers. Perhaps, complementary assets are more important and necessary for technology seekers, because without competitive complementary asset accessibility, profit from imitation is highly limited. However, profiting from licensing-out is common for innovators or technology holders with limited access to complementary assets (Gans & Stern, 2003).

Before imitating a technology, a technology seeker must observe its complementary asset accessibility relative to its competitors' or potential competitors'. At this stage, a firm can make the transition from a competition to cooperation strategy and vice-versa, but doing so has cost and other constraints, as accessing complementary assets requires sunk investments and cooperation requires a disclosure of assets and information, which opens up the possibility of substantial risk (Gans & Stern, 2003). However, deciding on an appropriate imitation strategy not only depends on complementary asset accessibility, but also on regimes of appropriability.

2.3.2 Regimes of appropriability

A regime of appropriability defined by Teece (1986) refers to "the environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovation" (pg.287). Its key dimensions are the nature of technology (product or process, and tacit knowledge or codified knowledge) and the efficacy of legal instruments (patents, copyrights, trade secrets).

First, operating in a weak appropriability regime does not mean a first-mover strategy will not work, nor does it mean that a fast-follower/imitator strategy will work. It simply means that an innovator or technology holder will need to protect its position by securing access

to complementary specialized assets, instead of technology (Pisano, 2006). In a weak appropriability regime, complementary assets often matter significantly, so that, core capabilities such as innovation or technology become less meaningful in these settings, because they are not well-protected. Capturing value from innovation requires the innovator or technology holder to have acquired complementary capabilities (e.g. manufacturing, distribution, etc.) (Pisano, 2006; Teece, 1986).

On the other hand, in a very strong or tight appropriability regime—typically seen in the chemical and pharmaceutical industries—the innovator or technology holder can specialize. It needs only a narrow range of core capabilities and can capture returns on innovation via the market. It does not need complementary capabilities, because economic return can be achieved via licensing contracts or strategic alliances (Gans & Stern 2003; Pisano, 2006; Teece, 1986).

Teece's (1986) original formulation took appropriability regimes as a given. In his formulation, appropriability regimes are determined by exogenous factors, which are legal forces, the scope and potency of patent protection, and the complexity of technology itself. According to survey research, a firm's propensity to rely on legal mechanisms varies across industries, which means that legal effectiveness varies across industries (Arundel, 2001; Cohen et al., 2000; Levin et al., 1987; Somaya, 2004). However, Pisano (2006) proposed the idea that recent

industrial changes resulted increase in endogenously influenced appropriability regimes. The behaviors and strategies of firms can significantly influence the appropriability regimes rather than just environmental factors. In other words, a firm itself can overcome an environmental-factor appropriability regime through suitable internal strategies. In this study, IPPs or patent portfolios, and patent management are found to be the key drivers for change, while the exogenous factor industry type (complex and discrete) remains the same (Cohen et al., 2000).

Among two key dimensions of appropriability regimes defined by Teece (1986), the efficacy of legal instruments is an exogenous factor because it differs by the IPR laws of each nation and industry type (Cohen et al., 2000). For instance, China and India have very weak appropriability regimes in which innovation instantly draws imitation (Pisano, 2006), and the pharmaceutical industry has stronger appropriability than the electronics industry (Cohen et al., 2000; Gans & Stern, 2003; Pisano, 2006). This exogenous factor is determined in this research by industry type. On the other hand, the other key dimension of appropriability regimes—the nature of technology—is also an exogenous factor, but it can be reinforced by an IPP. Endogenously manipulating the patent portfolio composition and structure will strengthen it. Low-complexity technologies combined together can be well-protected by appropriate IPP management,

eventually strengthening their appropriability regime(s). However, this exogenous factor can be strengthened endogenously by strategically manipulating patent portfolio composition and structure. Thus, an appropriate strategy also strengthens its legal power to strengthen the appropriability of innovation.

2.3.3 The dominant design paradigm

The dominant design paradigm consists of two stages: *the pre-paradigmatic stage* and *the paradigmatic stage*. During the pre-paradigmatic stage, the market is not yet ready to purchase the product or service. However, after considerable trial and error in the marketplace, a dominant design emerges. Once a dominant design emerges, the market has general acceptance on a certain design in which complementary assets play a larger role (Teece, 1986).

Dominant design emergence is important for technology seekers, as well as for innovators. Without dominant design emergence, imitated technology is of no use. Thus either technology seekers must be able to promote a dominant design or a dominant design must have already emerged.

2.4 Intellectual Property Portfolios

Intellectual property is an asset or assets under intellectual property law in terms of copyrights, trademarks, patents and trade secrets, and so on. Klevorick, Levin, Nelson, and Winter (1995) surveyed a large sample of senior R&D mangers. This empirical study showed that firms could seek to protect their innovation in various ways through different mechanisms of appropriability (patents, trade secrets, etc.) (Pisano, 2006).

2.4.1 Intellectual property portfolio and imitation capability

An IPP is a bundle of assets, as listed above. Technology-centered firms favor patents to protect their inventions due to their effective protections on economic returns (Firestone & Sciences, 1971; Hanel, 2006). Thus, a patent portfolio or patent stock typically represents a firm's knowledge stock or technological capabilities (Lach, 1995). Moreover, technological capabilities can be reinterpreted as innovation capability for technology holders or imitation capabilities for technology seekers. The technological capabilities of technology seekers—their *imitation capability*—should be solid and R&D-intensive (Schewe, 1996), so that technology seekers can create equivalent products or technologies.

2.4.2 An additional building block for Teece's PFI

In this study, an IPP is the additional building block added to Teece's to original three building blocks to define appropriability regimes with industry types. Increases in patent filing number and patent disputes during the past couple of decades implicitly indicate the importance of IPPs (WIPO, 2011). Teece did not point out the significance of IPPs to innovator strategy until 2006, when he published a reflection paper on his original article and admitted his lack of emphasis on IP. In his reflection paper, he claimed that his original article treated complementary technologies as just another complementary asset. Many technologies are systemic in that successful commercialization requires combining complementary technologies, as well as complementary patents (Teece, 2006). Thus, in this study, complementary patents and complementary technologies are interpreted as IPPs or patent portfolios, and they are not only for one's own use, but also for strategic use.

2.4.3 Strategic uses of IPPs for technology seekers

Firms can diversely exploit patents through their own use, licensing, blocking, and so forth (Blind, Edler, Frietsch, & Schmoch, 2006; Cohen et al., 2000). Patent exploitation done for non-direct commercialization uses (own uses and licenses) could effectively

generate strategic benefits such as patent blocking (Blind et al., 2006; Cohen et al., 2000). IP management is a great challenge for technology seeker (imitator). Technology seekers intend to penetrate blocking barrier, built by technology holders, using an IP portfolio, but they also need an IPP so as to design or develop imitative products or technologies. Furthermore, they try to build a new entry barrier by acquiring an IP to protect their imitation (Huang et al., 2010).

Due to the strategic advantages of patents, large firms keep commercializing competitors out of their core technology boundaries through patent blocking (Blind et al., 2006; Cohen, Goto, Nagata, Nelson, & Walsh, 2002). Furthermore, dominant incumbents have an incentive to engage in preemptive patenting, or patenting substitute technologies in advance of competitors to block the entry of potential competitors. (Blundell, Griffith, & Windmeijer, 2002; Gilbert & Newbery, 1982). For instance, in the 1991 *Honeywell v. Minolta* patent dispute case, Honeywell sued Minolta for infringement of its auto-focus camera patent, which was not in use by Honeywell. Minolta had to cease its commercialization and related business, plus get a loan from a bank to pay an indemnity ($127.5 million) to Honeywell (Kline, 2000). This case provides strong evidence of the effectiveness of preemptive patenting, which is discussed comprehensively in Implication and Imitation Strategies.

Similarly, patent flooding is a strategy in which a rival of a patent

owner obtains numerous patents on trivial variants of an initial patent in order to surround the competitor's patent or technology so that their competitor will find unable to develop improvements or find new uses for its patent without cross-licensing its patent with its rival. Consequently, this strategy gives very strong negotiation power that it can be effectively used for technology seekers.

In addition to patent blocking and flooding, another strategic use of patents allows for superior positioning in negotiations with partner companies, incentives for R&D personnel, and improved reputations (Blind et al., 2006). For instance, in the 1980s, Japanese semiconductor firms with competitive IPPs successfully settled a dispute against Texas Instruments (TI) via cross-licensing and moderate royalties, but Samsung with almost no semiconductor-related patents in U.S., paid royalties close to what seven Japanese firms have paid (Jung, 2005).

A superior negotiating position not only applies to technology holders (innovators), but also to technology seekers (imitators) under patent dispute litigation by technology holders (innovators). Many technology seekers litigated by technology holders survived and settled patent disputes with IPPs. Technology seekers (imitators) cannot move ahead on developing and commercializing new technology without access to rival technology from technology holder. Technology seekers can use their patents as bargaining chips either to compel their inclusion in cross-licensing or at least secure the freedom to move

ahead in imitation without being sued (Cohen et al., 2000). Related cases (e.g. Japanese semiconductor firms, Samsung PDP) are described in detail in Implications and Imitation Strategies. Along with bargaining power, a patent portfolio helps to easily form alliances with other firms, with evidence coming from computer, telecommunications (Kelley & Rice, 2002), and color printer industries (Park, 2011).

J. O. Lanjouw and Schankerman (2004) empirically showed that individuals and firms with small patent portfolios are at greater risk for patent disputes. The size of a patent portfolio is very likely to be correlated with another dimension of capability, such as protecting technologies and settling disputes, required to profit from innovation (Teece, 1986). Parchomovsky and Wagner (2005) suggested a theory of patent portfolios and explained the benefits of large patent portfolios. The benefits of large patent portfolios are operating with freedom, avoiding disputes, improving bargaining or defensive positions, addressing uncertainty related to technology and patent law, and so on (Parchomovsky & Wagner, 2005). Companies with roughly 500 patents in their portfolio are four times less likely to be involved in patent litigation (J. Lanjouw & Schankerman, 2003).

Because of the above-mentioned potential benefits, many firms do not care much about the value of individual patents, but simply seek to increase the quantity of their patents rather than the quality (Parchomovsky & Wagner, 2005). Thus, a patent race between capital-

intensive firms can be easily witnessed, such as a patent race between capital-intensive firms in the U.S. semiconductor (Hall & Ziedonis, 2001) and smartphone (e.g. Samsung, Apple, Google) industries. However, Arundel (2001) showed that large firms more actively utilize patents than do small ones; due to the economics of scales, it is only their tendency. Small firms can also utilize their patents actively and efficiently by strengthening their patent portfolio quality and patent design,[4] because the quantity of a patent portfolio is less important than its quality and relative legal strength in potential disputes. Thus, in this study, only the relative strength of the patent portfolio under potential patent dispute was considered.

[4] Patent design is, when filing a patent, intentionally designing a patent to avoid potential dispute and maximizing the complexity of the patent's information.

Chapter 3. In-Depth Case Study of the Smartphone Industry

In the past decade, diverse phenomena occurred in high-tech industries around the world. Technology seekers more and more imitate technology holders. The smartphone industry in particular is under the spotlight of many scholars due to numerous notable patent disputes, meaning there was frequent imitation. Thus, the smartphone industry is studied in-depth. The smartphone industry comprises a countless number of technologies from diverse industries. Although only the smartphone industry is studied and analyzed in this chapter, various other cases from different technology-centered industries (e.g. pharmaceutical, semiconductor, chemical, electronics, textiles, computer, telecommunication, and so on) are also analyzed for strategy development and included in Implications and Imitation Strategies.

3.1 The Smartphone Industry Patent War

Whereas the first smartphone, IBM's 1992 SIMON, faded away silently, the current smartphone industry has dramatically grown and is still growing and expanding at lightning speed. SIMON did not have much impact on the market and the smartphone industry, but the 2007

advent of the Apple iPhone changed the market trend and the industry. Smartphones are composed of various complex hardware and software packaged in a case that fits into the average adult palm. Due to this characteristic, a smartphone cannot be just called a cellular phone. Aside from its telephone function, smartphones also have camcorders, MP3 players, PDAs, digital cameras, eBooks, portable game players, navigation, Web browsing, and so on, and some smartphones are on par with the PCs sitting on the desk at home. This convergence of multiple functions and technologies represents the industry boundary disruption or industry convergence.

Multiple functions automatically enhanced the value of smartphone, and 300 million smartphones were sold worldwide in 2010, a 55% increase from 2009.[5] Unprecedented growth in the smartphone industry lured many hardware and software firms such as Google, Samsung, LG, Motorola, and Microsoft. This phenomenon even seems to mirror the California Gold Rush. The growth of this industry is accelerated by the prevalence of imitation—newspapers and other media outlets have been full of patent infringement litigation news related to the smartphone industry in the past few years

[5]Yoon, E. (윤의섭) (2011) Smartphone Patent War Outlook (스마트폰 특허전쟁 아웃룩). Korea Invention Promotion Association (KIPA). Invention Patent (발명특허) 36 (5), May 2011.

3.2 Samsung as a Technology Seeker

Following the success of Apple iPhone in 2007, followed by the iPhone 3G and 3GS models, one of the major handset makers, Samsung Electronics, released the Galaxy S with a Google Android OS in June 2010. In the past, Samsung has successfully imitated semiconductor technology from Japanese firms, so this smartphone me-too business strategy was not new to Samsung. Samsung maintained and referred to general smartphone functions and designs from smartphones in the market, particularly iPhone, but improved the hardware functions, display, CPU, battery, and RAM, areas in which Samsung specializes. Bluetooth and radio functions were improved and added, respectively, to enhance competiveness in software functions. Different from Apple's single product line, Samsung rushed into the smartphone arena with multiple product lines providing various designs and functions. Nevertheless, among multiple products, the Galaxy line was its core product, having the most advanced features and stirring the market.

3.2.1 Against the technology holder Apple

The 2010 advent of the Samsung Galaxy S was an unwelcome competitor to former Apple CEO Steve Jobs, and the Galaxy S II was even more powerful. On March 3, 2011, Jobs harshly censured several

smartphone manufacturers using the Google Android OS, such as Samsung, Motorola, and RIM, calling them "copycats." On April 1, 2011, Apple sued Samsung, Apple's critical components supplier, for infringement of 10 patents, three trade dresses, and six trademark icons.[6] The trade dress infringement claims include a rectangular product shape with rounded corners, a black-colored front, several icon designs, a bottom row of icons being fixed while flipping pages, and a metallic corner. Due to these infringements, Apple alleged that customers could confuse the Galaxy S with the iPhone 3G and 3GS.

The next day, Samsung countersued internationally. Among Samsung's strong patent portfolio on telecommunication, Samsung initially selected 10 patents to countersue with. Samsung alleged that Apple infringed on 10 patents related to 3G connectivity, wireless technology, power reduction during data transmission, and wireless data communications technology.[7] These patents were strengthened and developed during a decade of being one of the top mobile phone manufacturers in the world. This instant counterattack implies that Samsung was already prepared for this infringement battle, because Samsung knew the risk their products hold. In August 2011, a German

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[6] Patel N. (2011) Apple sues Samsung: A Complete Lawsuit Analysis. THE VERGE. April 19, 2011. http://www.theverge.com/2011/04/19/apple-sues-samsung-analysis/ (retrieved on Dec. 18, 2011)

[7] Patel N. (2011) Samsung sues Apple for Infringing 10 Patents: A Closer Look. THE VERGE. April 29, 2011. http://www.theverge.com/2011/04/29/samsung-sues-apple-infringing-10-patents-closer/ (retrieved on Dec. 18, 2011)

district court issued a preliminary injunction preventing Samsung from selling the Galaxy Tab 10.1 in every EU nation except the Netherlands, due to an infringement on of a trademarked design. A couple of weeks later, a Dutch court ruled that Samsung's Galaxy S, Galaxy Ace, and Galaxy SII smartphones infringed on one of Apple's patents, a technology used for scrolling and browsing behavior in photo applications, and should be removed from models imported or on sale by October 13.

However, Samsung made an update before the deadline to avoid a ban in the Netherlands and Germany. However, other design-related appeals were dismissed. Although the CEOs of the two firms met to mediate and negotiate cross-licensing with their patent portfolios, their efforts failed and a patent battle between Samsung and Apple is still ongoing. Due to the higher gravity of Samsung's technologies portfolio compared to Apple's trade dress and display patents, many experts expect this battle to conclude similar to the one with Nokia, or through a cross-license settlement.

3.2.2 Success in the market

Samsung successfully imitated Apple's designs, services, and functions, just as Samsung had successfully imitated some Japanese semiconductor firms' technologies. Samsung then enhanced its strong

field hardware to be competitive in the market. With strong complementary assets (manufacturing, distribution, and service) throughout the world, in its 2011 third quarter (July—September), Samsung beat Apple in world smartphone sales and became the world's top smartphone maker.[8] Compared to the preceding quarter, Samsung's sales went up 44% to 27.8 million units (23.7% of the world smartphone market), approximately fourfold from a year previously. On the other hand, Apple iPhone sales shrank by 16% to 17.1 million units (14.7% of the world smartphone market).

3.3 Apple as a Technology Seeker

In 2007, the Apple iPhone breathed new life into the dying smartphone industry using an imitation process. Apple's previous main playground had been in computers (iMac), laptops (MacBook), MP3 players (iPod), display monitors, and operating systems (Macintosh), but in 2007 Apple suddenly jumped into the smartphone business. Large mobile phone manufacturers such as Samsung, LG, Motorola, and Nokia had a firm grip on the feature phone industry at the time, holding most of the mobile phone-related technologies due to cumulated know-how and R&D capability. Therefore, Apple focused

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[8] Jin H. (2011) Samsung surges past Apple in smartphones, upbeat on Q4. REUTERS. Oct. 28, 2011 http://www.reuters.com/article/2011/10/28/us-samsung-idUSTRE79R0B620111028 (retrieved on Dec. 18, 2011)

on innovations in design, interface, mobile OS, and software, and then imitated weak fields like wireless communications and security technologies, which are core functions and technologies for mobile phones. Moreover, touchscreen, image display, and various other smartphone-related technologies were imitated. Apple has been part of a large number of infringement disputes due to its imitation.

3.3.1 Against the technology holder Typhoon Touch Technologies

In June 2008, Apple was sued by Typhoon Touch Technologies in the U.S. District Court for the Eastern District of Texas, with Typhoon alleging patent infringement on portable touchscreen technology.[9] Since Apple, originally a hardware manufacturer, had weak touchscreen technology portfolio, Apple could not present any bargaining chips to Typhoon; in September 2010, Apple settled the patent dispute for an undisclosed sum and the litigation was dismissed.

3.3.2 Against the technology holder Nokia

[9] Typhoon Touch Techs., Inc. v. Dell, Inc., case 6:07-cv-546, U.S. Dist.Ct., E.D.Tex. (Tyler Division), filed 2008-10-23. Plaintiff's complaint identified the patents as U.S. Patent No. 5,379,057: "Portable Computer with Touch Screen and Computer System Employing Same," and U.S. Patent No. 5,675,362: "Portable Computer with Touch Screen and Computing System Employing Same".

In October 2009, Nokia Corporation sued Apple for infringing on 10 Nokia patents relating to wireless technology. In December 2009, Apple countersued Nokia in the UK and Germany, and with the International Trade Commission (ITC) for infringing on 13 patents. Their battlefields varied and multiple disputes occurred, and this phenomenon was recognized as the first large patent battle the smartphone industry. During this patent war between Nokia and Apple, more than 40 patents were brought up in court, and Apple tried to invalidate Nokia's patent. Apple alleged the infringement of user interface-related scrolling and touchscreen technologies. On the other side, Nokia attacked Apple with telecommunications-related core technologies for mobile device. Apple's strengths, user interface technologies, are relatively trivial compare to Nokia's strengths, telecommunication technologies. After nearly two years of patent war, in June 2011, Apple admitted infringing on wireless data approach and transfer-, speech coding-, security-, and encryption-related technologies, and agreed to pay an undisclosed amount of cash and future iPhone royalties. There was no cross-licensing agreement made, but if Apple had a greater patent arsenal to defend and settle this dispute with cross-licensing, Apple could have avoided direct financial loss.

3.3.3 Against the technology holder S3 Graphics

In May 2010, Apple was pulled into another patent dispute. S3 Graphics filed an ITC complaint against Apple for infringement of four patents used in the iPhone, iPod Touch, iPad, and Apple computers. The litigated patents were encoding and decoding technologies for image processing systems, including the compression of image data files into a more compact form, a format for storing the compressed data, and a system for decompressing data for display as an image.[10] In response, in January 2011, Apple chose to use an invalidation strategy, which has a fair chance (Oh, 2009), and countersued S3 Graphics in California District court to invalidate the four claimed patents. However, in July 2011, a decision from the ITC went in favor of S3 Graphics. The ITC determined that Apple infringed on two patents owned by S3 Graphics, through not on the other two. S3 Graphics' infringed technology was already licensed by Microsoft, Sony, and Nintendo.[11] Interestingly, in July 2011, Taiwan based smartphone manufacturer HTC purchased S3 Graphics for $300 million to defend against infringement litigation by Apple. This acquisition will give HTC greater IP portfolio power against Apple in ongoing and potential disputes.

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[10] Schweibenz E. and Englehart A. (2010) S3 Graphics Files New 337 Complaint Regarding Certain Electronic Devices With Image Processing Systems. ITC 337 LAW BLOG. Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P. (retrieved on Dec. 18, 2011)

[11] Lowensohn J. (2011) ITC Ruling Mixed in S3 Graphics v. Apple. CNET News. July 1, 2011 Cnet.com(retrieved on Dec. 18, 2011)

3.3.4 Against the technology holder Motorola

Motorola filed a lawsuit against Apple in October 2010, claiming 18 patent infringements. Those 18 patents were for technologies related to MobileMe, the App Store, antenna design, wireless email, near-field censoring, application management, GPS service, multi-device synchronization, and so on.12 Apple struck back with a six patent infringement lawsuit. Those six patents were for technologies related to smartphone OSs, touchscreens, and multi-touch functionality. However, Google acquired Motorola in August, 2011.

After the acquisition was settled, patent disputes continued. In February 2012, Apple was forced to remove its 3G iPad 2, iPhone 3GS, and iPhone 4 from a German online store following Motorola's win in a German Court the previous winter. Apple's iCloud and MobileMe push email application were disabled on Apple iOS devices in Germany due to Motorola's win, and they are still banned as of June 2012.[13]

Motorola, the pioneer in mobile phones, has a strong patent portfolio in core technologies related to telecommunication that Apple

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[12] Mueller, F. (2010) Apple vs. Motorola: Now 42 Patents-in-Suit (24 Apple and 18 Motorola patents). FOSS PATENTS. Dec. 3, 2010. http://fosspatents.blogspot.com/2010/12/apple-vs-motorola-now-42-patents-in.html (retrieved on Dec. 18, 2011)

[13] Ingraham (2012). Apple vs. Motorola: Patent Infringement, Antitrust Accusations, and More. THE VERGE. http://www.theverge.com/2012/2/18/2808436/apple-vs-motorola (retrieved on June 27, 2012)

was no match for. Figuratively, the old man Motorola has more and stronger ammunition than the rookie Apple.

3.3.5 Apple acquired Nortel

Nortel Networks, the 120-year-old, nearly defunct Canadian telecommunications equipment maker, sold most of its tangible assets and business as of 2009, but its patents were still on sale until June 30, 2011. Nortel had 6,000 patents related to telecommunications technology. Its patent portfolio consisted of multiple telecommunications technologies such as the wireless technology long-term evolution (LTE), considered the future of telecommunications.

After its big patent-dispute loss against Nokia, Apple needed to strengthen its Achilles heel, a weak telecommunications patent portfolio. Apple needed more telecommunications patents, so it allied with Microsoft, RIM, Sony, Ericsson, and others to form a consortium known as Rockstar. On June 30, 2011, Rockstar acquired Nortel's patent portfolio for $4.5 billion in cash.[14] Initially Google was interested in Nortel's patents, and in April made a bid of $900 million, which fell far short of Rockstar's $4.5 billion offer. RIM, Canada's

[14] Nicholson (2011). Apple and Microsoft Beat Google for Nortel Patents. DealBook. *The New York Times*. July 1, 2011. http://dealbook.nytimes.com/2011/07/01/apple-and-microsoft-beat-google-for-nortel-patents/ (retrieved on June 26, 2012).

most outstanding technology firm, paid $475 million, while the Swedish firm Ericsson paid $340 million. Microsoft and Sony paid somewhat less. Apple, the leader of the consortium, paid $2.6 billion, more than half of the total acquisition cost.[15]

3.4 Google as a Technology Seeker

Several weeks after losing the Nortel acquisition, on September 15 Google acquired 1,023 patents from IBM. In so doing, Google's patents portfolio doubled to about 2,000 patents.[16] The acquired patents involve the fabrication and architecture of memory and micro-processing chips, relational databases, and object-oriented programming and business processes. Also, on August 15, 2011, Google successfully acquired Motorola Mobility Holdings, the mobile phone business separated from Motorola, for $12.5 billion.[17] Google was initially a software company with the Android mobile OS, but also

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[15]Park, H. (박현선) (2011). Apple spent $2.6 billion in Nortel Acquisition (애플, 노텔 특허 인수에 2조7000억원 썼다.) Etnews.com. July 22, 2011. http://www.etnews.com/news/home_mobile/information/2502580_1483.html (retrieved on June 22, 2012)

[16] Efrati (2011). Google Buys IBM Patents. *The Wall Street Journal*. July 29, 2011. http://online.wsj.com/article/SB10001424053111904800304576475663046346104.html (retrieved on June 22, 2012).

[17] Rusli and Miller (2011). Google to Buy Motorola Mobility for $12.5 Billion. DealBook. *The New York Times*. Aug. 15, 2011. http://dealbook.nytimes.com/2011/08/15/google-to-buy-motorola-mobility/ (retrieved on June 26, 2012).

with a manufacturing asset. However, Motorola, a pioneer in mobile phones, made Google an Android smartphone manufacturer with a large number of mobile phone-related patents. By acquiring Motorola, Google enhanced the quantity and quality of its patent portfolio by 17,000 stronger complementary assets, a manufacturing facility, and distribution channels. Thus Google can continuously promote the Android OS and prevent potential lawsuits with its stronger patent portfolio.

3.5 LG as a Technology Seeker against the Technology Holder Sony

In December 2010, Sony started a patent war by filing a lawsuit against LG Electronics in California District Court and with the ITC regarding the infringement of eight patents in LG mobile phones, the Lotus Elite, Neon, Remarq, Rumor 2, and Xenon. In response, in February 2011, LG filed an ITC complaint against Sony over eight patents regarding non-mobile phone products such as the Sony PlayStation 3, Bravia TV, Blu-ray player, and Vaio PC. At the same time in Southern California District Court, LG sued Sony regarding infringement on LCD TV, PC, digital camera, and camcorder patents. LG strategically had to switch the subject of dispute due to having a weak patent portfolio regarding the technologies used in its

smartphones. Rather than defending its smartphone technology with a weak portfolio, LG decided to attack other product lines, such as TVs, in which LG is strong.

After LG's attack on Sony Bravia, Sony sued LG TV and LG LCD monitor, and also tried to invalidate LG's patents. This battle spread worldwide. Litigation also occurred in Dutch and Danish courts. LG lost to Sony, and was forced to pay Sony €130,000 for litigations cost and €2 million for a false injunction on the PS3.

However, turnover happened when Zenith, a subsidiary of LG, showed up on the battlefield. Zenith was acquired by LG and has an essential patent, ATSC, which is a standard for digital broadcasting. Zenith sued Sony Bravia HD TV in Illinois Northern District Court, and in German and Spanish courts. After several battles all over the world, on August 11, 2011, Sony and LG settled their patent disputes by cross-licensing. A cross-licensing contract was undisclosed, but LG stock surged and Sony stock fell. This phenomenon in the stock market indicates that the cross-licensing contract was favorable to LG (KIPO, 2011).

Chapter 4. Implications and Imitation Strategies

4.1 Industry Differences

The in-depth case study in In-Depth Case Study of the Smartphone Industry exhibits multiple cases from the smartphone industry. However, not all industries behave or flow like the cases shown. Different industries have different atmospheres; for instance, the pharmaceutical and smartphone industries behave differently in terms of consumers, litigation, product development cost and time, and so on (Cohen et al., 2000; Mansfield, Schwartz, & Wagner, 1981). Moreover, different industries have different technological characteristics, such as the languages being used to describe or construct technologies in each industry, such as molecules in biotechnology, programming codes in IT, and circuit boards in electronics. Technological differences can be easily seen in patent filing documents.

4.1.1 Complex and discrete

To study the differences across the industry, various industries are categorized as either complex or discrete in terms of the nature of their technology and their legal effectiveness (Arora & Ceccagnoli, 2006; Cohen et al., 2000; Kash & Kingston, 2001; Kusunoki, Nonaka, &

Nagata, 1998; Levin et al., 1987). Cohen et al. (2000) suggested that the motives for patenting differ depending on whether the firm is part of a discrete or complex industry. Firms in complex industries usually need to use numerous, related, patentable technologies for one product, while those in discrete industries (e.g., chemical and pharmaceutical) need only patent a few. New drugs or chemicals typically are comprised of a relatively discrete number of patentable elements. In contrast, electronic products such as smartphones tend to be comprised of a larger number—often hundreds—of patentable elements and, hence, may be characterized as complex (Cohen et al., 2000).

Based on the International Standard of Industrial Classification (ISIC) code, Cohen et al. (2000) designated industries with an ISIC number below 2900 (e.g., food, textiles, chemicals, drugs, and metals) as discrete. Those with ISIC codes above 2900 (e.g., machinery, computers, electrical equipment, and semiconductors) were designated as being complex (Kusunoki et al., 1998).

4.1.2 A complex industry: prone to infringement

Complex industry as defined by Cohen et al. (2000) includes the machinery, computer, electrical equipment, and semiconductor industries. Following their classification, the smartphone industry should be included in complex industry, as a smartphone is a

combination of products from several complex industries. The countless number of patent disputes among smartphone firms proves the statement below, made by an executive of a communications equipment manufacturer:

> "Mostly, your patents are used in horse trading. You come together and say, 'Here's our portfolio.' In our industry, things all build on each other. We all overlap on each other's patents. Eventually we come to some agreement: 'You can use ours and we can use yours'." (Cohen et al., 2000, pg. 19).

This trend was visibly shown in the smartphone industry case study. Apple, Nokia, Motorola, S3 Graphics, Samsung, etc. infringing on each other was clearly shown. Some settled with cash and others through cross-licensing, with the last still under dispute, which is likely to be settled via cross-licensing. This trend is also shown in other complex industries, such as the semiconductor, PDP, PC, camera, and LCD industries, all of which behave like the smartphone industry. Implications and strategies are listed and analyzed under proposed strategies and outcomes in Tables 2 and 3.

4.1.3 A discrete industry: effective patent system

Discrete industry as defined by Cohen et al. (2000) includes food, textile, chemical, pharmaceutical, metals, biotechnology, and other industries. Compared to complex industries, discrete industry technology is relatively easy to imitate. For instance, a drug can be easily replicated by performing a chemical analysis on a finished product (Scherer, 2002). Furthermore, the R&D cost of developing a new compound is extremely high compared to the cost of imitating it (Grabowski, 2002).[18] It is for these reasons that effective patent protection is particularly important and necessary in the pharmaceutical industry, as well as in the other discrete industries. Thus the discrete industry has a higher patent premium[19] and greater patent effectiveness (Arora et al., 2008; Cohen et al., 2000).

Consequently, in discrete industries, patent rates for products or process innovations are very high: pharmaceuticals stand at 95.5%; chemicals at 68.90% and 61.49%, respectively; and petroleum at 37.74% and 61.49%, respectively (Cohen et al., 2000). Patents for licensing rates are also higher in discrete industries (37.5%) when compared to complex industries (28.8%), as patents are effective in preventing

[18] The capitalized cost of bringing a new drug to the point of marketing approval is $802 million (DiMasi, Hansen, & Grabowski, 2003). Additional research from the Federal Trade Commission found the costs to be higher—between $839 million and $868 million (Adams & Brantner, 2006).

[19] Patent premiums vary by industry: medical instruments (1.11); biotech (0.99); drugs and medicines (0.96); communications equipment (0.56); semiconductors (0.55); aircraft and missiles (0.46); electronics components (0.40); food, kindred, and tobacco products (0.28); and more (Arora, Ceccagnoli, & Cohen, 2008).

substitution and provide a strong basis for licensing (Cohen et al., 2000).

4.2 IP Portfolio and Industry Type Determine Appropriability regime

Complex and discrete industries have different patent effectiveness (Arora et al., 2008; Cohen et al., 2000); the appropriability strength of firms differs by industry type. Thus, appropriability is higher in a discrete industry with a well-protected regime.

An IP portfolio can be used as a strategic tool. Preemptive patenting— patenting substitute technologies in advance of competitors to block the entry of potential competitors (Blundell et al., 2002; Gilbert & Newbery, 1982)—is an effective strategy with a strong patent portfolio to enhance one's appropriability. In addition to patent blocking, the strategic use of patents allows a superior position in negotiations with partner companies (Blind et al., 2006) and the firm on the other side of courtroom. A relatively strong patent portfolio against an infringer during a lawsuit or infringement dispute negotiation will give relatively strong negotiation power and bargaining power and can thus strengthen the technology holder's appropriability.

While increased appropriability with a large patent portfolio could enable the owner firm to facilitate inward and outward technology

commercialization transactions (Arora et. al., 2001; Pisano, 2006; Teece, 1986), the effect might be moderated by its industry type (Lichtenthaler, 2009). In other words, the appropriability of a technology holder is determined by the relative strength of its IPP and industry type due to patent instrument efficacy differences. Thus, a two-by-two matrix (Table 2) was designed based on various case observations, including smartphone cases.

4.3 Imitation Strategies for Technology Seekers

Based on implications from various observed cases, a two-by-two matrix was developed to determine the appropriability of a technology holder. Imitation strategies and expected outcomes were derived with complementary assets added. Finally, an integrated commercialization strategy for the technology seeker was designed using Teece's (1986) three building blocks and IPP strategy.

4.3.1 Imitation strategies considering IP portfolios, industry types, and complementary assets

Table 2. Appropriability as determined by Intellectual Property Portfolio and Industry Type

		Technology Seeker's Intellectual Property Portfolio Relative Strength respect to Technology Holder[20]	
		Weaker	**Stronger**
Technology Holder's Industry type	**Complex**	Appropriability of Technology holder: **Weak**	Appropriability of Technology holder: **Very Weak**
		-Patent effectiveness low -Technology seeker has no bargaining power -Moderate litigation risk	-Patent effectiveness low -Technology seeker has bargaining power from stronger IP portfolio -Very low litigation risk
	Discrete	Appropriability of Technology holder: **Very Tight**	Appropriability of Technology holder: **Tight, but negotiable**
		-Patent effectiveness high -Technology seeker has no bargaining power	-Patent effectiveness high -Technology seeker has bargaining power from stronger IP portfolio. -bargaining power will reduce the cost.

When observing the relative portfolio strength in the two columns of Table 2, a direct quantitative comparison cannot accurately define the firm's position in terms of legal standing because, for many firms, the value of individual patents is not homogenous and is not their focus when patenting, due to many potential benefits that can be acquired from a large number of patents (Parchomovsky & Wagner, 2005). Also,

[20] Relatively strong Intellectual Property Portfolio means Technology Seeker's legal position respect to potential lawsuit sued by Technology Holder is strong, high chance of resolution via winning (defending) or settlement negotiation without financial loss.

a qualitative comparison, a value comparison, is not a suitable method because the value of one patent can possibly be different from another firm's perspective. Thus a relatively strong IPP means that a seeker's legal position with respect to a potential lawsuit by a holder is strong, with a high chance of resolution via winning (defending) or obtaining a settlement without financial loss. Just as balancing the commercialization of technologies developed both within and outside the firm requires a capacity for monitoring internal and external innovation (Cohen & Levinthal, 1989; Rosenberg, 1990), in imitation, the successful commercialization of technologies acquired by imitation requires a capacity for monitoring internal and external IPPs.

The 2×2 matrix (Table 2) has determined the appropriability of a technology holder using relative IPP strength, which is an endogenous factor, and industry type (complex or discrete), which is an exogenous factor. Upon obtaining a result, complementary asset accessibility is added. It compares the complementary asset accessibility of a seeker to its competitors, possibly a holder or other seeker.

Table 3. Imitation strategy and expected outcomes considering IPPs, industry type, and complementary asset

strategies[1] / outcomes		Tech. Seeker's Relative IP portfolio Strength against Tech. Holder - (Tech. Holder's Appropriabilty)			
		Complex Industry[2]		Discrete Industry	
		Weaker - (Very Tight)	Stronger - (Tight)	Weaker - (Weak)	Stronger - (Very Weak)
Tech. Seeker's relative accessibility to complementary assets against competitor(s)	Stronger	Imitate technology via license-in, then commercialize (1) Successful imitation and commercialization, but high royalty expected	Imitate technology via cross-license, and commercialize (2) Successful imitation (w/o financial loss) and commercialization	Imitate technology via invent-around or license-in, and commercialize (4) Likely to imitate w/o loss, and commercialize successfully	Imitate technology via invent-around, and commercialize (5) Success in imitation and commercialization (ideal)
	Weaker	Not only invent-around but, innovate upon it (innovative imitation) to license-out or sell, only if R&D capability is high enough. (3) Do not commercialize profit from royalty or sale only		Wait until stronger complementary assets are accessible. Imitation without a competitive complementary asset is meaningless unless an essential patent can be developed. (6) Tech. Seeker gains nothing under this condition. But, essential patent will benefit from royalty	

Commercialization ability of Tech. Seeker

[1] In each box, strategies on upper left and expected outcomes on lower right

[2] From a double-line in the middle, left is complex industry and right is discrete industry

4.3.1.1 Discrete industry strategies

Under Condition 1, potentially illegal imitation is a reckless choice. Due to the high effectiveness of legal protection for patents, licensing-in is the recommended imitation strategy. *Kolon vs. Du Pont* shows the risk of invent-around under corresponding conditions. In February 2009, Du Pont filed a lawsuit against Kolon for infringing on its chemical fiber Kevlar Aramid, which is used in bulletproof vests and helmets. In November 2011, a court found Kolon guilty of infringement and ordered it to pay $920 million in indemnities (KIPO, 2011). Thus, the licensing method is highly recommended under this condition.

However, a relatively high royalty is expected because of weak bargaining power from the weak IPP and the nature of discrete industries. Since patent effectiveness is strong, royalties are normally high; for instance, in the pharmaceutical industry, licensing an original drug from multinational firms (technology holders) costs a lot, and if the market share of a product soars, there is possibility that the original owners might take away the license and enter market themselves (Koh, 2005). Due to this risk, technology seekers usually wait until a patent expires before producing a generic drug using their complementary assets. Although high royalties and advantageous complementary asset positions will enable successful commercialization, royalties will also benefit holders. Relevant cases are typical pharmaceutical firms

operating with multinational firms' patents to manufacture and sell licensed drugs.

In Condition 2, because of the high effectiveness of legal protection for patents, licensing contracts are recommended as an imitation strategy. However, a relatively strong patent portfolio grants advantageous bargaining power to negotiate cross-licensing, which deters direct financial loss from royalties. A relevant case is that of the Dong-A Pharmaceutical Company, the largest pharmaceutical company in South Korea, again the New York City-based Bristol Myers. When Dong-A patented the antibiotic Amikancin and was going through the commercialization process, BM sent a warning letter claiming business abandonment on a business related to Amikancin. Dong-A imprudently admitted to infringement at first, but after careful investigation of the patent, Dong-A successfully settled the dispute through cross-licensing (KIPO, 2011).

Different from the first two conditions, when considering Condition 3 with weak complementary assets, we see that there is no competiveness in commercialization. Thus, imitation processes such as licensing-in and inventing-around are meaningless. However, if R&D capabilities are high, innovative imitation is recommended to profit from licensing-out or sales. Due to the high effectiveness of legal protection, innovative imitation can be well-protected. Patents are afforded sufficient protection for individual inventions in order to

confer monopoly rents via either the commercialization of an invention by the firm itself or via licensing (Cohen et al., 2000). In this case, a firm was initially a technology seeker but, after innovative imitation, became a holder. A relevant case is that of Sepracor Inc. In 1998, Sepracor, based in Marlborough, Massachusetts, innovatively imitated Eli Lilly & Company's market-leading antidepressant Prozac, which had only two years of patent protection left. Eli Lilly & Company would pay Sepracor up to $90 million to license a molecule in a purer form and with fewer side effects than the original Prozac.[21] Sepracor profited from innovative imitation via licensing.

4.3.1.2 Complex industry strategies

Under Condition 4 the recommended strategy is not clear, due to the possibility of infringement litigation risk. Licensing-in is a safe strategy; however, invent-around is reasonable as well, as the patentee winning rate around the world is rather low. After patent protection was made more uniform and indirectly strengthened by the U.S. government in 1982, the plaintiff winning rate in infringement suits and the number of infringement suits filed have all increased significantly (Kortum & Lerner, 1999; Lanjouw & Lerner, 1997; Merz & Pace,

[21] Fisher, L. (1998) Eli Lilly to Pay Sepracor $90 Million to License Drug, *The New York Times*. Dec. 8, 1998. http://www.nytimes.com/1998/12/08/business/eli-lilly-to-pay-sepracor-90-million-to-license-drug.html?src=pm.

1994). However, the plaintiff winning rate in the U.S. was around 24.43% from 2002–2004 (Janicke & Ren, 2006). In other words, 75.6% of infringers or imitators successfully access demanded IP assets such as technology, design, and trade. South Korea and Japan have similar success rates for infringers, at 74% and 80%, respectively (Sohn, 2012). This shows that proving infringement is not an easy task. In order to prove infringement, a patentee must collect all necessary data and present it to the court. A patentee sometimes must play hide-and-seek in order to appropriate one's IPRs (Oh, 2009). This implies that complex industries have higher success rates for infringers, as proving infringement is even more challenging and patent effectiveness relatively lower compare to discrete industries. The case of IBM and Korean PC manufacturers supports this; IBM filed a lawsuit against seven PC firms (LG Electronics, Hyundai Electronics, Hyosung Computer, and so on) for 160 patents. However, after a thorough analysis of the litigated patents, they only needed to pay for one infringed patent (KIPO, 2011).

Although the odds of winning are high for the infringer, some companies were almost bankrupted. In the U.S., intentional infringement triggers tripled indemnity payments, but rarely happens. One extreme case is Kodak vs. Polaroid, in 1976. Polaroid filed a suit against Kodak for infringement on 12 patents. Fourteen years later, Kodak lost and paid an indemnity of $925 million, closed a $1.5 billion

manufacturing line, and bought back 1.6 billion instant cameras from consumers (worth about $500 million) (Kline, 2000; Oh, 2009). However, almost all cases are ruled as non-intentional infringement, thus asking for licensing contracts ahead of time is a very naive action because, even though infringement is decided by the courts, royalty amounts do not change (Oh, 2009). Thus, invent-around is a reasonable strategy under this condition.

For Condition 5, the technology seeker literally has great power to imitate whatever is demanded. Patent protection on demanded technology is weak and not effective; Samsung SDI, a follower in PDP technology, was sued by Fujitsu, a leader in PDP business and technology. Samsung's SDI had such a competent patent force and strong patent portfolio that this dispute was settled via cross-licensing (Jung, 2005).

The following case contains implications for both Conditions 4 and 5. In 1986, the leading U.S. semiconductor firm Texas Instruments sued several Japanese semiconductor firms (Fujitsu, Sharp, NEC, Matsushita, and Hitachi) and the Korean semiconductor firm Samsung Electronics for dynamic random access memory (DRAM) technology infringement. The Japanese firms countersued with their patent portfolios while trying to negotiate a cross-licensing settlement. Toshiba successfully settled the dispute via cross-licensing. However, the other six Japanese firms settled the litigation by agreeing to make $138 million in royalty

payments. On the other side, Samsung, with very weak semiconductor patents in the U.S., paid $85 million. Samsung clearly had a very weak bargaining and negotiation power due to its weak patent portfolio (Jung, 2005).

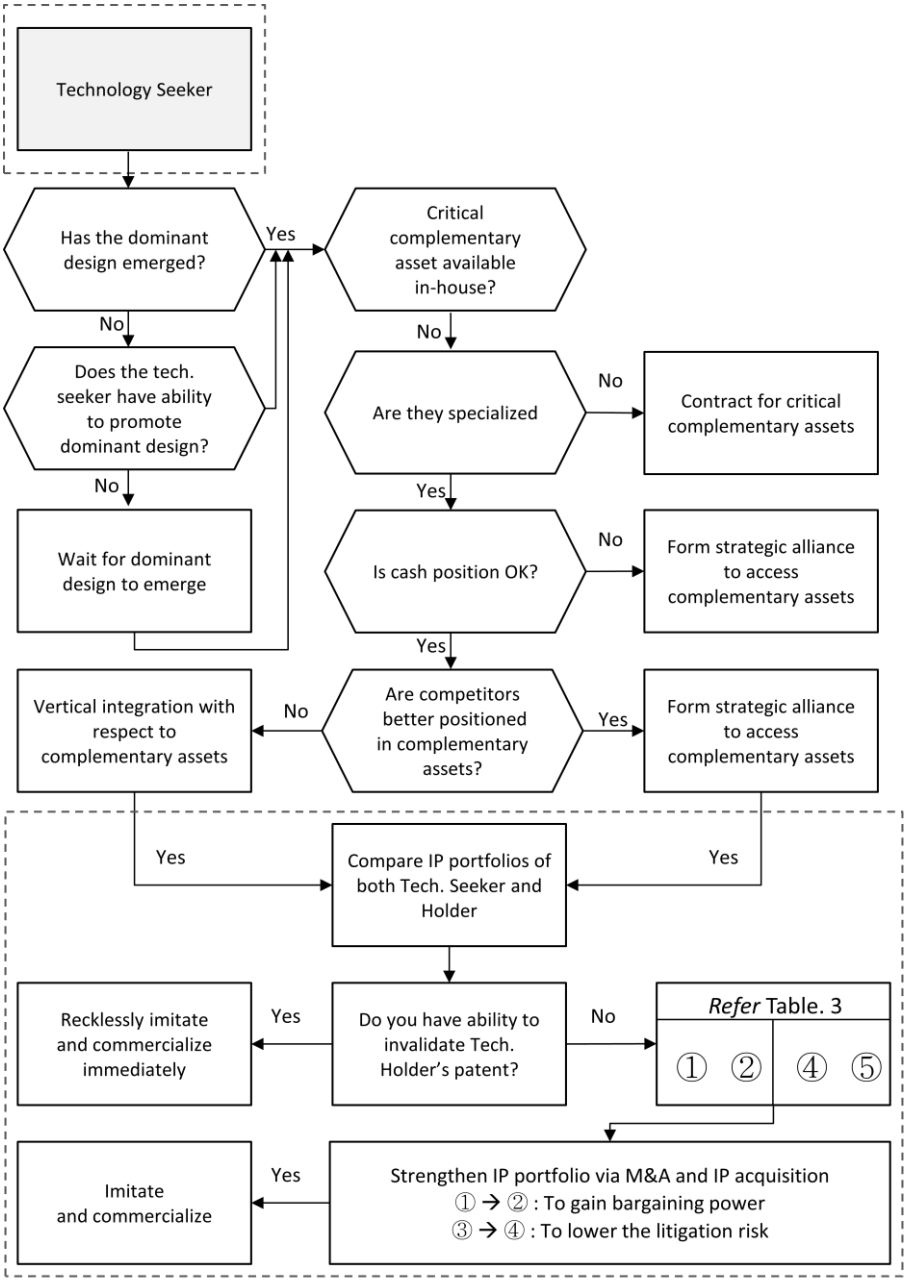
Condition 5 shows the importance in pre-analysis by a technology holder and that, although the technology seeker's IPP as related to a claimed patent is weak, other patents can reinforce its weakness. When LG stepped into the PDP business, it knew that Fujitsu and Matsushita held many original technologies. However, LG thought that the PDP business was very promising and decided to take the risk. LG invented-around most of the technologies to minimize potential risk. It knew the potential litigation risk and thus prepared for potential disputes with countermoves by patenting related technologies. In November 2004, Matsushita filed an injunction on LG's PDP module in Japan. The claim included five patent infringements related to PDP panels. LG was well-prepared and counterattacked regarding PC and DVD patents. This attack was very effective; in April 2005 the firms settled their dispute via cross-licensing, not only on PDP, but also on the PC and DVD patents (KIPO, 2011). This case is similar to the LG–Sony case.

Finally, under Condition 6, ironically, weak IP protection does not the technology seeker in this condition. Reverse-licensing-out imitated technology is not protected well enough for the strategy recommended for Condition 3 to be suitable. Also, imitation is meaningless without

competitive complementary assets. However, heterogeneity exists in complex industry as well (Cohen et al., 2000). Patent standardization (essential patents) will allow profits from licensing, which can help to overcome weak complementary asset accessibility. Once a patent becomes essential to a standard, the patentee's bargaining power surges because a prospective licensee has no other alternatives than licensing-in the essential technology. Relevant cases are Qualcom CDMA and Samsung MPEG-2. Patent standardization is usually found in complex industries and, although CDMA technology developed by Qualcom was used in a complex industry, it is an essential technology for which inventing-around is nearly impossible and thus became a standard technology for communications device (KIPO, 2011). Thus Apple, Nokia, Samsung, LG, and many other cell phone manufacturers reluctantly pay licensing fees for the technology.

Also, different from an original technology, an essential technology can be achieved by modifying existing technology (KIPO, 2008). Most of MPEG LA's essential patents in Korea were once not recognized as essential technologies, but after patent mining and modification, they became essential patents (KIPO, 2008). This case implies that patent mining a holder's technologies and imitating them with minor modifications can give a technology seeker significant bargaining power by making it an essential patent.

4.3.2 Profiting from technological imitation



Modified from Teece(2006)

Figure 2. Integrated Flow Chart Designed for Technology Seekers

In 1986, Teece developed a flow chart similar to the one shown in Figure 2. It was modified for this study to fit technology seekers/imitators and added additional blocks. Figure 2 shows steps to enhance complementary asset and IPP competitiveness. The arrow flows are not necessarily listed in chronological order. Dominant designs, complementary assets, appropriability, and IPPs are all blended within this flow chart as a technological imitation guideline. The dotted box indicates modifications made within this study. The steps prior to the dotted box are the steps for securing complementary assets and dominant design (Teece, 1986, 2006). Also, under "*Refer* Table. 3," only Conditions 1, 2, 4, and 5 are shown, because complementary assets are already strengthened in the previous steps.

4.3.2.1 Prior to the imitation process: analyzing a technology holder

Before proceeding with imitation, profound observation and analysis of the target firm is needed. A case addressed in the previous subsection, LG vs. Matsushita, greatly shows its importance. The *Canon vs. Xerox* case shows the importance of IP analysis by a technology holder. For this case, Canon analyzed a holder's portfolio to avoid any potential disputes. This method can be applied to imitation processes. Observing a holder's portfolios is a prerequisite for a seeker

to step into the imitation process. In this process, the seeker observes its foe's IP strength and simulates a potential patent dispute, along with searching for patents that can be invalidated (Jung, 2005).

4.3.2.2 Prior to imitation process: can you invalidate patent?

The invalidation rate on disputed patents is substantially high throughout the world and is still increasing (Oh, 2009). In the complex industry case *Samsung vs. SEL*, Samsung, a follower in the LCD business, gained 40% of the world market share in LCD technology. The original leader in LCD business, SEL filed a lawsuit in the U.S. regarding the infringement of TFT technology. Samsung carefully analyzed SEL's patent and found an administrative mistake made by SEL during patent filing. Samsung could thus strike back at SEL by invalidating SEL's patent.

On the other hand, discrete industry cases show similar trends in terms of patent invalidation. In April 2001, Honeywell filed a complaint with the ITC against Hyosung for infringement on PET yarn and treated fabric. Honeywell claimed that these products were being sold in the U.S. without permission, and that Honeywell wanted a sales injunction in the U.S. In response, Hyosung made an active counterclaim against Honeywell, and in March 2002, a court stated that Hyosung did not infringe, and that Honeywell's patents were invalid

(KIPO, 2011). The pharmaceutical industry, known to very strong patent regimes, often shows patent invalidation cases. Fourteen generic drug manufacturers had winning records against original drug manufacturers in Korea from 2000–2009, winning 37 out of 48 (77.1%) cases (Jung, 2009).[22] Therefore, careful pre-analysis of a technology holder's IPP can make the imitation process much easier, as there is always a good chance of patent invalidation.

4.3.2.3 Strengthening IP portfolio

Mergers and acquisitions and IP acquisitions are very important for seekers to reduce patent disputes, enhance complementary asset competitiveness, and strengthen their bargaining power with a stronger IPP. Readdressing the smartphone cases, Google acquired more than 1,000 IBM and Motorola patents, including a manufacturing line and a large patent portfolio. Apple's alliance group acquired Nortel's 6,000 patents. LG acquired Zenith, which helped its dispute with Sony. These acquisitions are very costly but very effective due to saving time.

[22] Jung, Y. (정윤택 외 3명) (2009). Pharmaceutical Sector Evergreen Patent Strategy and Dispute Case Study. (제약분야의 에버그린 특허전략과 분쟁 사례 연구). Korea Health Industry Development Institute (KHIDI) (한국보건산업진흥원).

Chapter 5. Conclusion

5.1 Summary of Findings and Contributions

Imitation is more prevalent than innovation, but the world sharply condemns it as shameful and dishonorable and does not recognize it as an effective business strategy (Levitt, 1966). Effectively utilized imitation will enhance the profit and growth of a firm. Thus, the development of a systematic imitation strategy seems to be needed. A total 25 different cases from various industries were observed, and combined implications from each case were blended and became an integrated imitation process framework for imitators/technology seekers in all industries (discrete or complex) (Table 3).

Technology seekers (imitators) can follow the strategies based on their complementary asset accessibility and on a technology holder's appropriability regime. The appropriability regime of a technology holder is determined via its industry type (discrete or complex) and relative IPP strength (Table 2). The definition of *appropriability regime* here differs from that of Teece (1986). In this study, an appropriability regime is a combination of the IP portfolio endogenous factor and the industry type exogenous factor, while Teece (1986) defined it with two exogenous factors, the efficacy of legal instruments (protection) and the nature of technology (imitability). An appropriability regime is not a

given factor that a firm cannot endogenously alter. Strengthening its IPP will strengthen a firm's technology appropriability and protect its profits from potential loss. Upon the determined appropriability of the technology holder, complementary asset accessibility—which represents commercialization capability—is used to provide integrated imitation and commercialization strategies for the technology seeker.

In a discrete industry, due to effective patent protection, legal imitation and licensing is recommended, but in a complex industry, invent-around—which is potentially illegal—is mostly recommended due to weak patent protection. Without complementary assets, however, profiting from imitation is very challenging and limited. Innovative imitation and standardizing imitated technology are the only possibilities for profiting from licensing-out without having a competitive complementary asset.

In Table 3, recommended strategies for six different conditions are mostly affected by relative IPP strength. This study shed light on IPPs in imitation processes. Previous work related to IPPS only focused on innovation, and their perspectives were those of innovators. In this study, however, IPPs were used to enable imitation and reduce legal dispute risk. Thus IPPs form a protective tool for both technology seekers and holders, as well as a negotiation and bargaining tool for technology holders during the imitation process.

The result of this study clearly provides systematic imitation

strategies for technology seekers in various industries, as well as combining Teece's three building blocks-dominant design, complementary assets, and appropriability regimes, with the additional building block of IPPs into an appropriability regime. While existing research focuses only on innovation and does not connect the highly effective IPP tool with the imitation process, this study used IPPs as a key imitation tool.

5.2 Limitations and Further Research

The heterogeneity of each industry is significant enough that Cohen et al.'s (2000) industry categorization (discrete or complex) is implemented for ease of analysis. Thus, rather than selecting an industry type to determine the efficacy of legal instruments in different industries, categorized technology or patents would have been more effective and accurate because each technology shows different characteristics, because and legal instruments are applied in various ways.

Since this study focuses on imitation strategy, further studies should contain a bilateral strategy containing both innovation and imitation elements, which is far more efficient than a single strategy of either innovation or imitation; indeed, a firm should not choose only innovation or imitation. It is not a binary element such as 1 or 0, nor is

it a black-and-white strategy. A gray strategy must be achieved to establish a thriving, efficient organization.

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Appendix A. Case list

#	Industry Type (D or C)*	Condition (0) – (6)**	Technology Seeker (Initially Sued)	Technology Holder (Patentee)	Note
1	C	(4)-(5)	Apple	Samsung	Par level of IPP
2	C	(4)-(5)	Samsung	Apple	Par level of IPP
3	C	(4) Failed	Apple	Typhoon Touch Technology	Apple w/ relatively weak IPP → paid cash to settle
4	C	(4) Failed	Apple	Nokia	Apple w/ relatively weak IPP → paid cash to settle
5	C	(4) Failed	Apple	S3 Graphics	Apple w/ relatively weak IPP → paid cash to settle
6	C	(4) Failed	Apple	Motorola	Apple w/ relatively weak IPP → paid cash to settle
7	C	(4)→(5) Succeed	Apple	Nortel	Apple gained IPP strength by acquisition
8	C	(5) Succeed	LG	Sony	Cross-licensing via a circuit attack
9	C	(4)&(6) →(5) Succeed	Google	Motorola IBM	Gained complementary asset and IPP. Killed two birds with one rock.
10	C	(4)→(5) Failed	Google	Nortel	Google failed gaining IPP strength
11	C	(4)→(5) Succeed	HTC	S3 Graphics	HTC gained IPP strength
12	C	(4) Failed	Samsung	TI	Samsung had weak bargaining power due to weak IPP (paid large cash)
13	C	(5) Succeed	Japanese 7 firms	TI	Strong bargaining power from strong IPP
14	C	(4) Succeed	Korea PC	IBM	Got a way (159/160 infringement claims), only 1 infringed
15	C	(4) Failed	Kodak	Polaroid	Intended Infringement (paid triple to settle)
16	C	(5) Succeed	Samsung SDI	Fujitsu	Cross-licensing with strong IPP
17	C	(0)-(5) Succeed	LG	Matsushita	Cross-licensing, A circuit attack, Pre-analysis on technology holder's IPP
18	C	(0) Succeed	Samsung	Japan SEL	Patent invalidation Success
19	C	(0) Succeed	Canon	Xerox	Pre-analysis on technology holder's IPP
20	C	(6)	QUALCOMM (CDMA)		Essential Patent (standardization success)
21	C	(6)	Samsung (MPEG-3)		Essential Patent (standardization success)
22	D	(0) Succeed	Hyosung	Honeywell	Patent invalidation success
23	D	(3) Succeed	Sepracor	Elli Lilly	Sepracor licensed back out via innovative imitation
24	D	(1) Failed	Kolon	Du Pont	Kolon nearly bankrupted due to one lawsuit
25	D	(2) Succeed	Dong-A Pharm.	Bristol Myer	Cross-licensing with competitive IPP

* D: Discrete Industry & C: Complex Industry
**Conditions from Table 3 and (0) condition is patent invalidation (refer section 4.3.2.2)

초 록

지난 10년 간, 특허 침해 소송 빈도수의 가파를 상승을 보면 알 수 있다시피, 기업간의 모방이 끊임없이 그리고 갈수록 더 많이 일어나고 있다는 점을 알 수 있다. 이러한 현상을 증명하듯, 최근 뉴스나 신문에서 특허소송관련 기사를 찾는 건 어렵지 않은 일이 되었다. 이러한 잦은 모방의 주요원인으로 산업간 장벽의 붕괴와 융합으로 보는데, 특히 카메라, 라디오, DMB, 게임기, 이메일, 전화, 결제 기능 등등 다양한 기능의 집합체인 스마트 폰 산업에서 두드러지게 보인다. 하지만 안타깝게도, 혁신전략연구는 수십 년 동안 끊임없이 지속되어왔지만, 체계적인 기업 모방전략을 제시하는 연구는 아직 걸음마 단계이다. 따라서, 잦아지는 특허침해소송과 모방(imitation)을 보았을 때, 체계적인 모방전략의 필요성이 있다. 과거 혁신만을 추구하고 집중하던 석학들의 연구 중 David Teece (1986) “Profiting from Technological Innovation”의 3개 핵심요소, 전유성(appropriability regime), 보완자산 (complementary asset), 지배적 디자인(dominant design)에 특허 포트폴리오 및 산업 특성 (complex & discrete)을 조합하여, 기술수색자 (Technology seeker)입장에서 주어진 조건별 어떤 모방전략이 채택 되야 하는지 및 기대 결과를 보여주는 가이드를 만들었다. 이 모방전략 가이드라인은 총 25개의 기업

사례와 50개의 기업들이 언급된다. 이 연구에서의 가장 큰 발견은, 특허 포트폴리오의 새로운 용도이다. 과거, 특허 포트폴리오는 기술 혁신가에게 있어 기술의 권리 및 사업을 지키기 위한 수단이었지만, 이제 특허 포트폴리오는 기업의 기술 전유성을 내생적으로 조절할 수 있게 해주는 중요한 요소이다. 과거 Teece (1986)는 기업 전유성은 외생적으로만 결정된다고 주장하였으나, 특허 포트폴리오의 강화는 기업의 전유성을 내생적으로도 강화시킬 수 있게 해준다. 또한, 특허 포트폴리오는 기술 수색자, 즉, 기술수색자 또는 모방가에게 있어 기술모방에 꼭 필요한 핵심 도구이다. 상대적으로 강력한 특허 포트폴리오는 교섭력을 향상시켜 기술소유자 (Technology holder)의 기술 모방 후 추후 발생 가능한 분쟁으로부터 기술 수색자의 위험부담을 감소 시켜주는 역할을 한다.

주요어: 특허 포트폴리오, 보완자산, 전유성, 모방전략, 특허침해소송, 산업특성

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