

A glowing lightbulb with a butterfly on its top and a glowing green cocoon inside. The background is dark, and the lightbulb is illuminated from within, casting a green glow. The butterfly is perched on the top of the bulb, and the cocoon is visible inside the bulb's glass envelope.

INTERNATIONAL STANDARDIZATION AS A STRATEGIC TOOL

**Standardization and patent pools:
Using patent licensing to lead the market**

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Standardization and patent pools: Using patent licensing to lead the market



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Summary

This paper explains why profit-seeking companies participate in standardization activities and patent pools, even if the activities benefit their rival companies, and pays special attention to the relation between standards and patents.

We examine the question from the perspective of economic theory using the concepts of the tragedy of the anti-commons and leap-frogging. The tragedy of the anti-commons explains why companies cross-license their patents and the patent policies of standardization organizations imply cross-licensing. The leap-frogging describes why companies who own essential patents to implement standards license their patents to companies who have no related patent.

By granting licences to others, companies are rewarded in the short term with economic benefits and in the long term with strategic opportunities to exert influence on market trends.

In the final section, recommendations are given to private companies, based on the considerations given in this paper.

1 Introduction

There are two types of standardization activities; public activities supported by governments and voluntary forums and consortia comprised of private companies. Regardless of their type, objectives of the activities include maintaining product interoperability, disseminating technologies and product information, improving production efficiency and quality, and eliminating barriers to trade.

Standardization benefits society. We can use battery-powered electronic products anywhere since battery standards provide global interoperability. However, these standards do not benefit any one specific battery manufacturer. Rather the standards are used by all manufacturers, intensify market competition and contribute to world trade. The story is not limited to the battery industry. In general, standardization contributes to intensifying market competition.

Why then do profit-seeking companies participate in standardization activities if the activities also benefit their competitors? Several papers have already studied the question. Schmidt and Werle studied the International Telecommunication Union (ITU) and found that institutionalized rules facilitate consensus building [1]¹, but the ITU is a public entity where there is pressure from governments on private-sector participants to facilitate consensus. There are more than 100 forums and consortia in the world, participants in which seek consensus even though governments do not participate.

¹ Figures in square brackets refer to the Bibliography.

Mattli and Büthe found, on the basis of a questionnaire survey, strategic reasons and concluded that standards are not formulated in the technical sense but for political reasons [2]. Besen and Farrell recommended a method of strategically using standardization [3]. However, these researches were from the viewpoint of political science.

We also need to examine the question from the perspective of economic theory. This paper first reviews the conventional explanation using industry modularization, then introduces two theories; the tragedy of the anti-commons and leap-frogging.

Special attention is paid to “standardization” of standardization organizations’ patent policies. A patent holder has the exclusive right to exploit his/her invention, which is the core concept of the patent system. However, the patent policies, not only of public entities but also of private organizations, request that patent holders permit the following: if a patent is believed to be essential to a standard, its holder must agree to license the patent without discrimination. There is no notion of exclusive right. Why do companies accept patent policies in which the exclusive patent right is not guaranteed?

2 Modularization and the necessity of interface standards

Researchers explain the necessity of standardization relating to compatibility standards using the concept of modularization in industry.

Baldwin and Clark state that modularization generally has three purposes [4]: to make complexity manageable; to enable parallel work; and to accommodate future uncertainty. They found “hidden modules” and claim that “*design decisions in those modules do not affect decisions in other modules*” and “*in the hidden modules, designers may replace early, inferior solutions with later, superior solutions*”.

The relation between a Personal Computer (PC) and a telecommunications network is an example of hidden modules. A user can upgrade the telecommunications network from dial-up to Digital Subscriber Line (DSL) and further to Fiber-To-The-Home (FTTH) without replacing his/her PC. He/she also can replace his/her PC from a low-performance model to a higher performance model without changing the communications network.

In order to realize the hidden module scheme, it is necessary to standardize the module interface precisely. Otherwise, if no compatibility standard exists, the greater the number of module providers, the greater the inter-module transaction costs. Interface standardization among module providers is a way to reduce the transaction costs.

Telecommunications, information, electronics and electrics are industries where market competition is extremely severe and compatibility standardization activities are the most active. In these industries modularization is on-going.

3 Prevention of the tragedy of the anti-commons

This section describes why companies cross-license their patents and the patent policies imply cross-licensing.

3.1 The tragedy of the anti-commons

Let us assume companies A and B conduct R&D (research and development) in the same area. The companies have individually filed patent applications, which have been examined and granted separately. These granted patents do not overlap because of the authorized patent examination system.

In such a situation, suppose that a new product requires both of the patents from the two companies. If either of the two companies refuses to license its patent to the other, the entire set of accumulated technologies becomes useless. This is what is called the “tragedy of the anti-commons”.

This phenomenon contrasts with the famous “tragedy of the commons”, which refers to a situation in which the yield is reduced as a result of the over-use of common land by individuals. The tragedy of the anti-commons occurs when a number of individuals claim rights to a single land property and eventually make it unavailable.

The tragedy of the anti-commons can be explained by applying game theory, which studies the strategic situations of multiple players [5]. Schmidt and Werle already applied the theory to the standard-setting process [1]. Here we apply it to understand the relation between the two patent holders.

Table 1 – Game theory expression of the tragedy of the anti-commons (simplified example)

		Company A	
		Does not license A's patent	License A's patent
Company B	Does not license B's patent	Case 1: (0, 0)	Case 2: (0, 1)
	Licenses B's patent	Case 3: (1, 0)	Case 4: (0,5; 0,5)
NOTE (x, y) is the market size company A and B expect, respectively.			

Source: Prepared by the author

Let us examine Table 1. Companies A and B choose from two actions: to license to its counterpart and not to license to its counterpart. If companies A and B both refuse to license (Case 1), no company will gain the market. If company A decides to license but B refuses (Case 2), B only will monopolize the market. If company B decides to license but A refuses (Case 3), A only will monopolize the market. If both companies licence each other (Case 4), the market will be divided in half. For Companies A and B, Case 3 and 2 are the best, respectively, but this Nash equilibrium implies no license to the counterpart (Case 1). This is a typical game of prisoners' dilemma. The tragedy of the anti-commons is the situation where both companies insist on the exclusive patent right.

In the telecommunications, information, electronics and electrics sectors, a large number of companies around the world perform R& D in similar areas. As a result of equally competent researchers pursuing inventions in overlapping research areas, many different companies own patents related to the same technology. However, marketable products and services need these patents. In addition, in these sectors, it is common to combine modules that involve multiple patents owned by different companies. This characteristic of the industry sectors may cause the tragedy of the anti-commons.

After playing the game through repeatedly, the industry gets to know the second best solution. The solution to the tragedy of the anti-commons is cross-licensing the related patents and realizes case 4. There are scores of cross-licensing agreements in the telecommunications, information, electronics and electrics sectors [6]. This fact has led companies to deny the core concept of the patent system, patents as exclusive rights. In this regard, both standardization activities and patent pools are attempts to solve the tragedy of the anti-commons through patent licensing.

Now we can explain why companies accept patent policies of standardization organizations: there is a chance patents essential to implement a standard might be held not only by itself but also by competitors. However, execution of the patent policy also admits companies who have no patent to use the patents. Is this acceptable? This question is answered in Section 4.

3.2 Reciprocity

The ITU Telecommunication Standardization Sector (ITU-T) patent declaration form [7] that must be filled out and submitted to ITU-T by patent holders uses the word “reciprocity”. What is the meaning of “reciprocity”? The ITU-T guideline [8] explains that reciprocity means that *“the patent holder shall only be required to license any prospective licensee if such prospective licensee will commit to license its essential patent(s) or essential patent claim(s) for implementation of the same ITU-T Recommendation...”*.

It is understandable that the reciprocity is a direct expression of the willingness of cross-licensing. A solution for avoiding the tragedy of the anti-commons is explicitly implemented in ITU-T.

Toshiba, Hitachi, Matsushita Electric, Mitsubishi Electric, Time Warner, Victor, IBM, Sanyo Electric, and Sharp organized a patent pool called DVD6C in 1999 for Digital Versatile Disc (DVD) patent licensing. Outside of the patents managed by DVD6C, there are other essential DVD patents owned by Philips, Pioneer, Sony and LG. They have formed their own patent pool called DVD3C.

A company that intends to enter the DVD market needs to obtain licences from both patent pools. The members of DVD6C and those of DVD3C have cross-licensed their patents so that both sides can access to the market. In its general licensing agreement [9], DVD6C requests licensees *“to grant each of the participating companies of DVD6C (and their licensees) a non-exclusive license on fair, reasonable and non-discriminatory terms to use any of their patents that are deemed essential for the manufacture, use or sale of DVD Products”*.

This scheme is called “grantback” in DVD6C, which is identical to reciprocity.

4 Strategic response to leap-frogging

Let us now consider why companies who own essential patents to implement standards license their patents to companies who have no related patent.

4.1 Leap-frogging

Let us assume the following:

- only two companies A and B exist in the market.
- company A produces the current products whose output is X_A at the unit cost C_A while B's output is X_B at the unit cost C_B ; and C_A is smaller than C_B .
- The inverse demand function is written as $p = -a(X_A + X_B) + b$, where p is the product price, and a and b are constants.

These assumptions represents Cournot's duopoly model. At equilibrium, the profits P_A and P_B of companies A and B, respectively, are easily calculated by differentiating the following equations (1).

$$P_A = (p - C_A)X_A \text{ and} \quad (1-1)$$

$$P_B = (p - C_B)X_B \quad (1-2)$$

Solutions are:

$$P_A = (b - 2C_A + C_B)^2 / 9a \text{ and} \quad (2-1)$$

$$P_B = (b - 2C_B + C_A)^2 / 9a \quad (2-2)$$

Since C_A is smaller than C_B , it is obvious that P_A becomes larger than P_B .

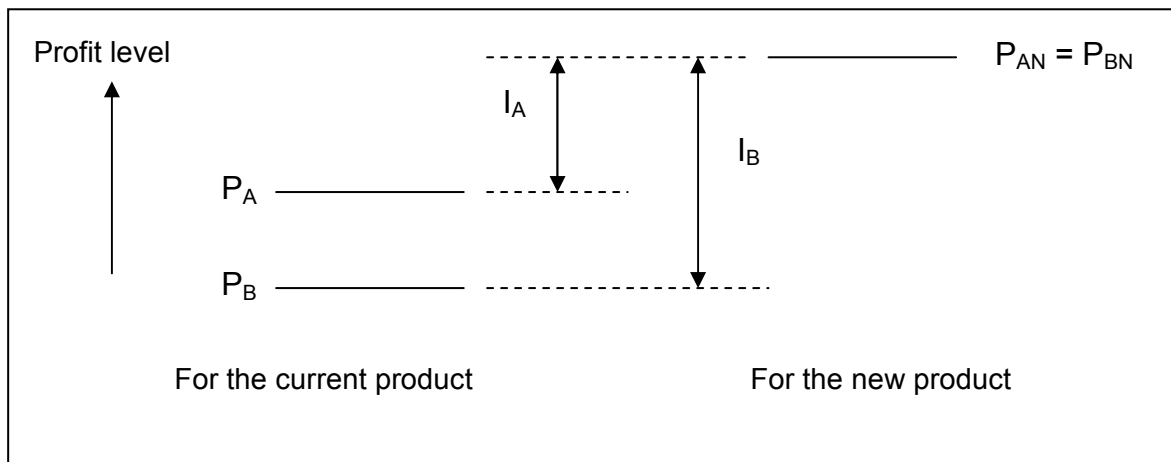
Then let us assume the following:

- the two companies face a particular timing to introduce a new product. The unit cost is estimated C_N in both companies.
- by the introduction of the new product, the inverse demand function is expected to move right- and upward (i.e. market expansion expectation). The new demand curve is $p = -a(X_A + X_B - d) + b$ where d is a constant.

According to these assumptions, the expected profits of the two companies P_{AN} and P_{BN} are calculated:

$$P_{AN} = P_{BN} = (ad + b - C_N)^2 / 9a \quad (3)$$

Even if P_{AN} is larger than P_A , the difference I_A between P_{AN} and P_A is smaller than $I_B (= P_{BN} - P_B)$. The situation is shown in Figure 1.



Source: Prepared by the author

Figure 1 – Comparison of the current profit and the expected one with no royalty payment

The calculation suggests that company A, which earns a larger profit from the current product, has a smaller incentive to introduce the new product, even if the market is expected to expand, than company B who earns a smaller profit now. In other words, company A prefers the earnings from the cash-cow current product to the risk-taking of new product introduction or, in short, company A is risk-averse [10]. In the calculation we assumed the market expansion expectations to be identical for both companies, but if company A forecasts a smaller market expansion than company B does, company A is more likely to hesitate to introduce the new product.

The calculation explains why the Innovator’s Dilemma occurs. The Innovator’s Dilemma is the concept proposed by Christensen [11]. He found that the leading company fails to catch up with the market trend when facing disruptive technologies, and results in leap-frogging the market position: the leader position of the next generation product is taken away by companies that ran behind in the current market or new entrants.

There are case examples of leap-frogging such as Christensen’s hard disc market. Another example is that in the optical storage market where the leading Compact Disc (CD) company failed to maintain leadership in the next generation, i.e. DVD. Incumbent telephone operators were slow in adopting the Internet compared to new entrants, thus failing to gain market leadership in Internet businesses.

The product life cycle is short in the electrical, electronics, and information and telecommunications technology industries. The first market entrant can establish its brand name in the market, and it becomes difficult for latecomers to overtake the market of the first entrant. This phenomenon is

called the first-mover's advantage. How to avoid leap-frogging and maintain the first-mover's advantage is a strategic challenge for the leading company.

4.2 Strategy to avoid leap-frogging

How can the leading company maintain its market position even after the change in product generation? A strategy can be derived from considering licensing A's patented technologies to company B.

Let us modify the profit equations (1) as follow.

$$P_A = (p - C_N)X_A + rX_B \text{ and} \tag{4-1}$$

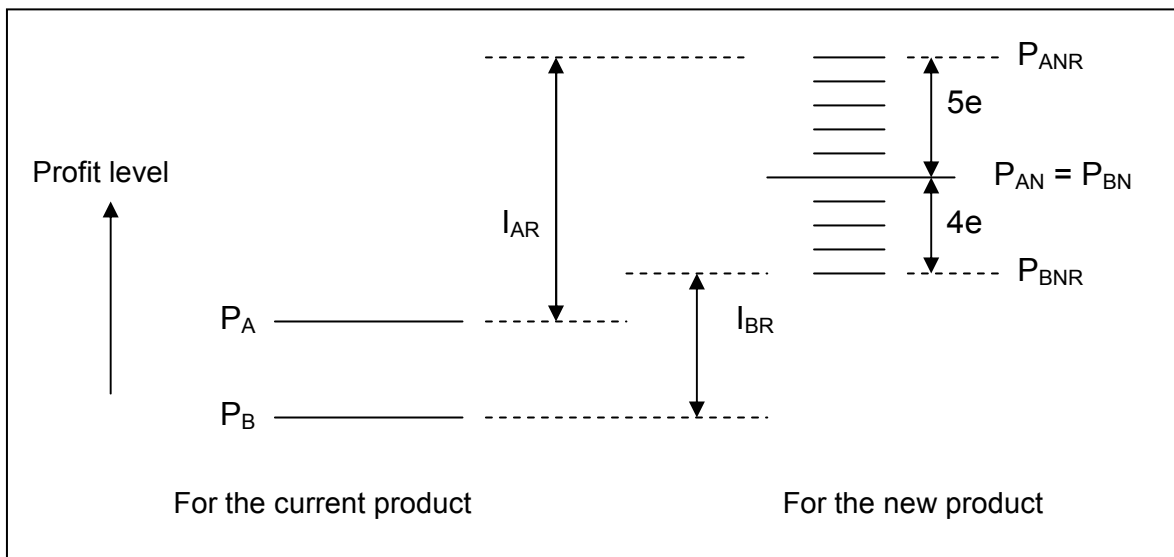
$$P_B = (p - C_N)X_B - rX_B \tag{4-2}$$

The new equations (4) mean that company B pays royalty r to company A when selling every unit of the new product. By performing the same calculations we obtain the following solutions P_{ANR} and P_{BNR} at equilibrium.

$$P_{ANR} = P_{AN} + 5r(ad + b - C_N - r) / 9a \text{ and} \tag{5-1}$$

$$P_{BNR} = P_{BN} - 4r(ad + b - C_N - r) / 9a \tag{5-2}$$

The new equilibrium calculated by the equations (5) is shown in Figure 2 where factor e represents $r(ad + b - C_N - r) / 9a$. Figure 2 demonstrates I_{AR} ($= P_{ANR} - P_A$) is able to be larger than I_{BR} ($= P_{BNR} - P_B$), if factor e is positive and reasonably large. Although we wish to avoid complex mathematics in this paper, the condition is realized, if royalty r is kept at an appropriate level.



Source: Prepared by the author

Figure 2 – Comparison of the current profit and the expected one with royalty payment

Licensing to the second runner increases A's incentive for the new product introduction, hence, increasing the possibility of maintaining the market leadership or the first mover's advantage over the product generation.

Now we can explain why companies accept standardization organizations' patent policies that request patent holders to license their patents to companies who have no patents: licensors have a possibility of obtaining profits larger than licensees taking account of royalty payment.

5 Practical implementations

The previous two chapters explain why standardization organizations' patent policies are appropriate. This chapter explains how the avoidance of the tragedy of the anti-commons and leap-frogging benefit patent holders.

5.1 Patent pools

It often happens that a single set of standards can be associated with patents owned by several different companies. A manufacturer wishing to manufacture a product that complies with the standards needs to be licensed from each respective owner of the related patents. To simplify this licensing process and set a reasonable aggregate royalty for a package of relevant patents, patent holders sometimes choose to form a "patent pool".

A typical example of patent pools is the one regarding Motion Picture Experts Group 2 (MPEG-2) video coding standards. In 1997, Columbia University, Fujitsu, General Instrument, Lucent Technologies, Matsushita, Mitsubishi, Philips, Scientific-Atlanta, and Sony formed a patent pool for MPEG-2. Under this mechanism, the relevant essential patents of these entities are pooled through an independent agency that was appointed to provide licensing and royalty collection services. Collected royalties are shared among the patent-pool participants.

Relating to DVD, this paper has already explained DVD6C and DVD3C. There are several other cases of patent pools.

5.2 Earnings from royalties

Let us examine a simplified example shown in Table 2.

Suppose that a product uses patented technologies separately owned by companies A, B and C. Company A licenses its patent to companies B and C in exchange for licences from them. Royalties that the three parties pay to one another are offset by the payments they receive. Consequently, each of the three is using the other two's patented technologies free of charge. The economic value of using three patents by offering one patent is equivalent to a three-fold improvement in R&D efficiency. On the other hand, Company D and other parties without patents must pay a 1% royalty to each of the three patent owners.

**Table 2 – Effective royalties required for product sales
(simplified example)**

Payer \ Receiver	A	B	C
A	0%	0%	0%
B	0%	0%	0%
C	0%	0%	0%
D and other parties without patents	1%	1%	1%

Source: Prepared by the author

The total amount of royalties can be exceptionally large. For example, the aggregate amount of royalties received by the DVD6C member companies can be estimated as follows.

The size of the global optical disc equipment market was 268,62 million units for 2005 based on a report published by the Japan Electronics and Information Technology Industries Association [12]. On the assumption that the market is split 50/50 between CD and DVD equipment and a US\$ 3.00 royalty is charged per unit², the DVD6C could collect as much as US\$ 400 million in total. The Japan Recording-Media Industries Association estimated that the global recordable DVD market

² The royalty information is presented in DVD6C website at <http://www.dvd6cla.com/>

reached 3930 million discs in 2005 [13]. This number multiplied by the royalty of US\$ 0.065 per disc equals US\$ 255 million. The sum of the royalties for equipment and discs, US\$ 655 million, is shared among the DVD6C members.

The same is true, for example, for MPEG2 technology. Earnings from royalties bring holders of essential patents a financial benefit that is the reward obtained by avoiding the tragedy of the anti-commons and leap-frogging. The earnings are the income without operation of a manufacturing line; therefore, the scheme implies large financial efficiency.

5.3 Ease of establishing patent infringement

Establishing patent infringement, from gathering evidence to paying litigation expenses, is usually a costly process, because the suspected party always denies the allegation. In some cases, the litigation cost exceeds several million US dollars [14].

This is not the case with standard-compliant product. Companies selling products that comply with standards cannot deny their use of patented technologies essential to implement the standards and, therefore, have no other choice but to pay royalties.

In this manner, the owners of the patents essential for implementing the standard can efficiently identify licensees and earn enormous amounts of money without waiting for the outcome of infringement litigation.

5.4 Maintaining the first-mover's advantage for a long time

The leading company should adopt a strategy for minimizing the risk of losing its current dominance and maintaining market leadership over the long term. The most significant risk is the challenge of the second runner: the second runner has a chance to challenge market dominance by creating a more attractive product through R&D.

One way to lessen the second runner's motivation to carry out R&D is to promise to license the patented technologies since this can relieve the second runner of the need to develop alternative technologies.

Once such a partnership is established, the leading company can always be the first to introduce a new product onto the market, while having the second runner follow suit after a given delay. If this situation continues, the second runner becomes a "good follower" for the leading company. Under this principle, the leading company can buy the time to enjoy the first-mover's advantage for a long time.

In the early 2005, IBM and Sun Microsystems announced to non-discriminatory license patents relating to the open source free of charge [15]. This trend can be regarded as strategies for creating good followers in open-source business.

Similar strategies have been adopted by Japanese companies. The DVD6C and DVD3C, most members of which are Japanese, signed licence agreements with Chinese DVD player manufacturers in 2002. This is an attempt to make Chinese manufacturers good followers and secure profits.

Standardization organizations regardless of whether they are public or private adopt similar patent policies in which it is written that holders of patents essential to implement standards must license their patent as non-discriminatory. Considering the fact that almost all essential patents are held by companies in developed countries, patent policies can be regarded as a way of protecting their market leadership from being overtaken by developing countries.

6 Conclusions and recommendations

This paper explains why companies participate in standardization activities, even if the activities benefit their rival companies. Licensing of their patented technologies creates short-term financial benefits and long-term strategic benefits for the patent holders. These are the reasons why the exploitation of patents as licences is becoming more common in electrical, electronics, information and telecommunications technology industries.

We would like to recommend private companies to take the following measures.

6.1 Exploiting patents as licenses

Companies should step up efforts to acquire more patents. This is a prerequisite to benefiting from patents.

In parallel with acquiring patents, companies should consider a way of using them as licences. For a company that owns powerful patents, licensing them to others rather than using them exclusively, may seem to conflict with its own interest; in fact, this approach has strategic value.

Companies should take a serious step toward leading the market through the exploitation of patents as licences.

6.2 Taking advantage of standardization activities as political negotiations

Some companies, Japanese companies typically, have a bad habit of attending standardization activities quietly; sitting silent at the meetings. Since standardization activities can be a negotiation tool, it is not enough to simply participate in such activities. Firstly, it is necessary to measure the necessity of participation. Then, after making the decision to participate, they must participate in activities aggressively by submitting technical proposals, inviting and chairing meetings, and so on. Companies should move proactively to have their patented and non-patented technologies incorporated in standards. These recommendations are common regardless of the form of standardization activities whether it is public or private.

Standardization activities are political negotiations and not a forum for assessing which technologies excel over others. Therefore, companies should delegate skilled negotiators to participate in such activities. Companies should also provide their employees with educational opportunities to improve their negotiation skills.

6.3 Exploring the possibility of forming patent pools

If the participants in a standardization activity come to recognize a patent pool as a future option, coordination may become easier. Companies should initiate negotiations with others for the creation of a patent pool if their future visions require such a facility.

It must be understood, however, that formation of a patent pool is not a universal mechanism because the formation involves significant coordination costs. The greatest inhibitor is the cost of organizing a patent pool. Examinations of patents' essentiality require the involvement of unprejudiced experts³, and such a process is expensive. When expected earnings from royalties are likely to justify the assumed expenses, companies should move to create a patent pool.

³ Before the creation of the MPEG -2 patent pool, its members asked the US Federal Government to verify that their conduct would not violate the federal antitrust laws. The Department of Justice responded by issuing a document confirming that this patent pool would not conflict with the antitrust laws as long as it licensed only the essential patents on a non-discriminatory basis and involved no price-fixing or similar agreements.

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