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Evidence from Questionnaire Survey**

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# IPR-Standardization Interaction in Japanese Firms: Evidence from Questionnaire Survey\*

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## Abstract

To disentangle the relations between standards, innovation and competition, this paper examined the processes and effects of standardization in Japanese firms. The realities of their activities were provided by a postal questionnaire sent to progressive large firms in Japanese industries.

Overall, although Japanese firms have sufficiently understood the significance of increased standardization, they don't always actively and strategically involve in the standardization process. The conclusion may be derived from the respondents' evaluations that 1) the effects of standardization are less likely to be profitable; 2) formal standard setting organizations are not always an effective coordination mechanism of intellectual property rights; and 3) they don't have a sufficient internal institution for standardization strategy. They are rather skeptical of particularly formal and semi-formal standardization processes.

**Keywords:** Consensus-based Standards; Split Type of Standardization; Intellectual Property Rights; Standards Setting Organizations; Patent Hold-up

**JEL classification:** L15, L22, L41

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## Introduction

There is little doubt that R&D and innovations are the driving forces of a firm's growth and viability, and further, of industrial and economic development. Therefore, a great number of studies have examined the factors affecting R&D and innovations in a theoretical and/or empirical way. In particular recently, the role of standardization in innovation is receiving more interest from the viewpoint of both corporate strategy and public policy, since it may have a large influence on innovation and competition among firms.

Doubts have been grown, and now are still growing over the competitiveness of Japanese industries. Their cost minimization as advantage has approached the limit for two reasons: First, labor costs are still of the highest level in the world. Second, cost controls through “kaizen” and subcontracting are more difficult. As a result, even in the fields with competitiveness, their dominance has been or is being eroded by challenges from the world growth center. Now, the companies have a stronger preference for product innovation than for process innovation.

The industries have still relatively larger capability to develop new technologies. But, larger technological capability may not be sufficient for revitalizing Japan's industries, since it may not always lead to improved competitiveness and innovations. The situation may be called “Japan's Paradox.” There may be barriers which prevent new inventions to transfer into innovation processes. Standardization, in particular global one, of invented new technologies is likely to be a key for solving the paradox. It is because standardization is expected to be able to facilitate efficiency and innovation.

Recently, the importance of technology standardization in competition is emphasized. To disentangle the relation between standards and innovation, it is important to examine the processes and effects of standardization. But, study is scarce which examines standardization strategies, in particular in Japanese firms, due to data restrictions. We don't know the reality of their activities sufficiently.

In this paper, answers were provided largely by a postal questionnaire sent to progressive large firms in Japanese industries. This paper, which examines an overall feature of standardization strategy-makings, is a report from the on-going research project. The organization of the paper is as follows. The first section suggests the split type of standardization, which seems to be increasingly prevalent among Japanese firms. The discussion may be *a priori* and theoretical base for this empirical analysis. The second section describes the methodology of the paper, and examines some major features of Japanese standard performers. The third to fifth sections discuss the results from the questionnaire. And finally, there are conclusions and then suggestions for further research. Here, standard is defined as “standardized format”.

## I Patterns of Standardization: Split Type of Strategy

### I.1 Consensus-based Standardization

The fierce competition for dominant technology format, which was typically found in VTR and recently the new generation of DVD (Blue-Ray vs. HD-DVD), aroused increasing concern with standardization through inter-firm competition, which is usually called the “*de facto* standardization”. But, in fact, more standards have been formed through non-competition processes. The processes include a variety of cooperative forms such as “voluntary consensus” through formal or informal standard-setting organizations (SSOs) and “mandatory consensus” such as public regulations of safety, health, environments and fair trade (which are frequently of a “compliance” type). The two latter types are collectively called “consensus standards”. In fact, much of the key standardization activity in ICT sector is carried out by industry consortia and formal SSOs. But, it is noted that the consensus-building process frequently may include intense interactions among participant firms, which are just like competitive processes found in the *de facto* standardization. The definition of standards is used comparatively loosely, and therefore may be different among business persons depending on their business experiences.

Also, it is noted that most of firms always face any of various types of standards, implying that all firms should take into account standardization in all aspects of corporate strategy-making. In fact, firms to a certain extent understand the backgrounds where standardization is necessary. In particular, as suggested later, two factors are rather important: complicated technology structure of a product, and regulatory standards such as safety, health, environment, and fair trade regulations which are usually called “social standards” (See Table 4).

The consensus is usually formed by joining newly-established or existing SSOs, business associations and other alliances. Recently, surging interest is in SSOs as patent coordination mechanism. It is attributable to the fact that many of new inventions frequently build on a complicated configuration of technologies and complementary assets. They may not only have innovation & efficiency-promoting effects, but also involve their specific antitrust concerns, since the consensus-building and consensus-implementing processes may include restricted competition. Therefore, standards are among policy agenda in both industrial development and competition policies. Put alternately, public policies may exert an influence on business standardization strategies.

## I.2 Split Type of Standardization Strategy

A distinction is usually drawn between product and process innovations and improvement (“kaizen”). In recent years, many firms tend to emphasize the importance of product innovation. In fact, most of the respondents in this survey suggest that product & service innovation (including product improvement) is overwhelmingly more important than process innovation & improvement (*i.e.*, 92 out of 93 available responses). Product innovation is likely to involve more areas of technologies.

Firms frequently compete in certain areas of a product, and at the same time cooperate in other areas. A combination of cooperation and competition is sometimes called “co-opetition” (Nalebuff & Brandenburger [1996]). Nalebuff and Brandenburger [1996] suggest that firms frequently cooperate to create a new or bigger business “pie”, and win a larger share of the pie through competition. Such a hybrid behavior is possible in standardization process. In fact generally, there is scarcely the standard which governs most portions of a product. But, existing studies fail to look at the fact, and emphasize largely the types of standards and their timing in standardization. Recent standardization cases suggest the importance of “standardized areas” of a product. Therefore, the existing studies have not examined the areas of standardized technologies, and their effects on competition in an “end” product market.

Thus, many progressive industries with patent-intensiveness are on the threshold of new types of cooperation. It is the “split” type of standardization. In general, standardization is likely to induce fierce competition through increasing homogenization of products, and then to declining profitability and competitiveness. For example, in electronics industries in Japan, before, comprehensive licensing and cross licensing agreements have been implemented, which have included both infrastructural and application technologies. The consequence was larger homogenization and standardization of a product, and then more fierce competition, in particular from overseas firms<sup>(1)</sup>. Such situations might have a negative influence on the evaluation of effects of standardization strategies in Japanese firms, although the agreements frequently have led to expanded market.

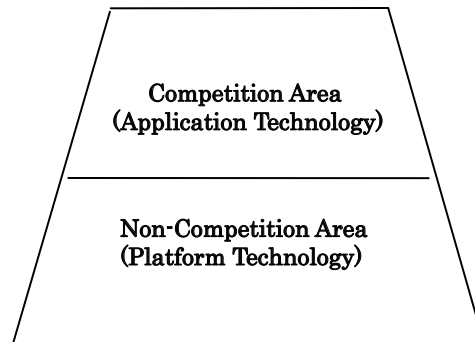
One of the possible solutions for a firm is the “split” of a product between cooperative standardization area (non-competition area) and independent and competitively-differentiated area (competition area). Firms try to standardize the particular areas of a product (or service) to increase their competitive advantages

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<sup>(1)</sup> They were combined with “modularization”. See for example Shintaku *et al.* [2006].

through differentiation and discretion in other areas, and finally in the whole product. This solution is also of a type which is emphasized by EC as key of its competitiveness-promoting policy.

Figure 1 Split Model



As shown in Figure 1, firms strategically divide a product or a technology into the two areas: “competition area” for application technologies and “non–competition area” for platform (or basic) technologies. In the non-competition area, firms co-operate each other for standardization, while they emphasize individuality strategies such as differentiation and innovation in the competition area. The strategy suggests that firms may have areas which can be successfully standardized without losing competitiveness of differentiation in a product. For example, such behavior can be found in automobile, electronics and optical instruments sectors<sup>(2)</sup>. In this survey, 63 out of 93 available responses (from various industry sectors) agree with the statement that “*the ‘split’ strategy is of a preferable type*”.

Thus, the split strategy may be due to the possibility that standardization has ambivalent effects for firms. While firms can win the standardization benefits of both increased efficiency (for example, economies of scale from larger production of homogeneous product) and created or expanded markets, they may simultaneously reduce or lose the opportunity of gaining competitive advantages from individual differentiation and innovation. But, the split strategy may capture both benefits of standardization and differentiation. But in fact, there are many firms that don’t understand sufficiently the implications of the split strategy or the effects of standardization on competition area.

Now, we are interested in “how firms manage the split and interface between

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<sup>(2)</sup> See Doi *et al.*[2008] and Doi *et al.*[2010] respectively for automobile and digital camera.

cooperation and competition in standardization process, or in the transfer processes of new inventions into standardization”. Then, intellectual property right(s) (IPR and IPRs) as protection may have a significant influence on standardization activity. And, as industrial economics and organizational economics suggest, standardization behavior is likely to depend on external and internal environments or relationships of a firm.

Figure 2 Corporate Triangle

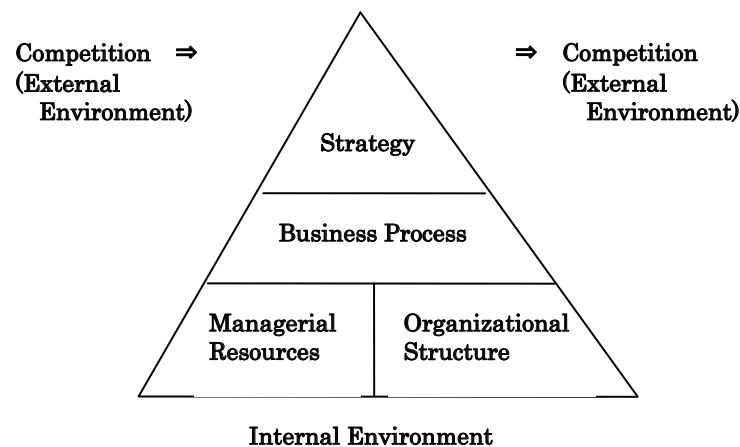


Figure 2 shows that firms formulate standardization activities under both the internal (strategy, business process, managerial resources and organizational structure) and external (competition, competitors, market structure and public policies) environments. These relationships and in particular the relations between IPRs, standards and competition have not been sufficiently examined in a theoretical and empirical way. To analyze the effects of standardization on competition and innovation and then on economic welfare, the competitive impacts of the split type of behavior are necessary to be discussed.

The above discussion is a theoretical development. Based on the discussion, the following main problems can be picked up:

- 1) There are some major difficulties in application and implementation of IPRs. In particular, patent conflicts may be very important. One of the solutions for the conflicts is consensus standardization through various types of SSOs and public regulations.
- 2) But, there are several difficulties in consensus standardization process as well,

which are related to both internal environments of a company and the governance and management of SSOs. They are likely to have an influence on the evaluation of standardization effects.

- 3) There are alternative solutions for very difficult coordination of patents in consensus building processes. Those difficulties and their solutions may have an influence on standardization processes.

Whether the relationships derived from those broad problems were reflected and captured in the responses were discussed in this paper.

## II The Methodology and Sample of Questionnaire

In general, as suggested earlier, standardization strategy may be determined under the interaction between the internal and external environments and business strategy. One of the possible determinants is the “internal management” of standards and intellectual property. A combination of questionnaire survey and field interview was utilized. The approaches include the questions on the internal institutions and evaluations of standardization<sup>(3)</sup>.

The questionnaire was sent to heads of IPR units probably responsible for also standards in a sample of 447 IPR-conscious performers in April 2009. The firms were selected largely from the member of the *Japan Intellectual Property Society* and included some additional large firms. Most of the sampled firms, who were listed in the stock exchanges, seemed to be “IP-conscious” in strategy-making. They have a special unit with full-time responsibility for IPR.

We received 93 effective responses until the end of April. Unfortunately the return rate, 21.0 percent is very low. Possibly, radically-declining business activity since fall 2008 might have an influence on the return.

Table 1 shows the distribution by sector (*i.e.*, 2-digit industry) of responses. 69 percent of the responses are from the two “IPR-intensive” sectors of chemicals and machines (general machinery, electrical appliances, transport equipments and precision instruments). Other companies also are IPR-intensive. Many respondents suggested that their responses were the official statements of their companies. It should be noted that the industry classification does not always capture the business composition and diversification of a company precisely.

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<sup>(3)</sup> The questionnaire-based studies are for example Blind *et al.*[2002] and Blind[2004] for European firms, and Striukova[2006] for major firms in the world. Also see JFEO[2008] for Japanese firms.



Table 1 Response Distribution by Industry

| Industry Sector | No. of Firms | Industry Sector         | No. of Firms |
|-----------------|--------------|-------------------------|--------------|
| Food            | 2            | Non-ferrous metals      | 4            |
| Fiber & textile | 7            | Metal products          | 4            |
| Pulp & papers   | 2            | General machinery       | 12           |
| Chemicals       | 27           | Electronical appliances | 11           |
| Petroleum       | 0            | Transport equipments    | 10           |
| Rubber          | 1            | Precision instruments   | 4            |
| Clay and stone  | 3            | Others                  | 3            |
| Steels          | 3            | Total                   | 93           |

There are some methodologies for answering questions. First, respondents were asked to rate the importance of several possible factors and statements to the decision, promotion and success of IPR and standard strategy. The questions were largely based on Blind *et al.*[2002], since the EC survey covered many general aspects in standardization processes<sup>(4)</sup>. Also, comparison with EC findings was possible. In this survey, some Japan-specific questions were added.

And, rating was in most cases on the three- to five-point scale of 1 to 5 (*i.e.*, 5 : “*very high*”, 4: “*high*”, 3: “*medium*”, 2: “*low*”, and 1: “*very low*”), 1 to 4 (*i.e.*, 4: “*high*”, 3: “*medium*”, 2: “*low*”, and 1: “*very low*”), and 1 to 3 (*i.e.*, 3: “*high*”, 2: “*medium*”, 1: “*low*”). Second, the “yes/no” type questions were provided for them. Finally, respondents were asked to select the contents which they think are most suitable for their own views. But, the number of responses is different from question to question, since some respondents were sometimes reluctant to reply to sensitive questions.

Also, some face-to-face interviews were complementarily conducted. The target was 20 firms which were all in machines sector. From these methodologies, we may suggest the common understandings or evaluations, which are likely to be prevalent in the business world.

### III Results from the Questionnaire: IPR Management

Now we will examine the results from the questionnaire in turn. The results are shown in Tables 2 to 10. These tables show the number of respondents selecting a particular scale in response to questions, based on the rating of a scale of 1 to 5. The results for the yes/no type questions and others are shown in the text with no table. The tables show the mentions, their distributions and means.

<sup>(4)</sup> The EC survey (Blind *et al.*[2002], pp.216-218) does not publish detailed results, only summarizing major findings. In general, Europe is a front-runner of standard research.

This section starts in Table 2 with the presentation of the results of the first question concerning the way for protecting and appropriating newly-invented technologies. At the beginning, it is important to understand IPR protections. Firms can protect their technologies by the use of any of alternative methods. Among possible methods are “*Patents*”, “*Trademarks*”, “*Copyrights*”, “*Secrecy*”, “*Lead-time advantages*”, “*Customer relations management*”, “*Long-term contracts*”, “*Exclusive contracts with suppliers*”, and so on. Firms were asked about the importance of those methods to protect new inventions. The results for the question are shown in Table 2.

Table 2 Protection of Technologies

| Protections                           | Rating of Importance |     |        |      |           | Mean |
|---------------------------------------|----------------------|-----|--------|------|-----------|------|
|                                       | very low             | low | medium | high | very high |      |
|                                       | 1                    | 2   | 3      | 4    | 5         |      |
| ① Patents                             | 3                    | 2   | 4      | 15   | 69        | 4.56 |
| ② Trademarks                          | 2                    | 15  | 28     | 21   | 27        | 3.60 |
| ③ Copyrights                          | 16                   | 33  | 30     | 10   | 3         | 2.47 |
| ④ Secrecy                             | 2                    | 7   | 27     | 25   | 30        | 3.81 |
| ⑤ Lead-time advantages                | 3                    | 5   | 23     | 36   | 25        | 3.82 |
| ⑥ Customer relations management       | 1                    | 10  | 42     | 28   | 10        | 3.40 |
| ⑦ Long-term contracts                 | 4                    | 18  | 33     | 29   | 6         | 3.17 |
| ⑧ Exclusive contracts with suppliers  | 3                    | 15  | 45     | 26   | 2         | 3.10 |
| ⑨ Complex product design              | 16                   | 29  | 32     | 9    | 3         | 2.48 |
| ⑩ Embody intangible assets in product | 15                   | 22  | 31     | 18   | 4         | 2.71 |

The respondents suggest that “*patents*” (mean mention rate – shortly mean score – 4.56) are the most important protection in the sample. And “*trademarks*” (mean score 3.60), “*secrecy*” (mean score 3.81) and “*lead-time advantages*” (mean score 3.82) are strategically important as well. In particular, patents have the greatest preference, which is rather different from the evidences found in US and Europe that patents are less effective than lead-time (or first-mover) advantages and secrecy (See for example Greenhalgh and Rogers [2010], pp.152-154 for US, and Blind *et al.*[2002], p.217 for EC). The difference may be due to the fact that most of the responses come from sectors with higher “patent premium”.

Also, it is noted that non-patenting methods such as secrecy and lead-time advantages are very important, being consistent with the recent trend of declining patent applications among large firms<sup>(5)</sup>. But, the “confidentiality-based” methods such

<sup>(5)</sup> One interviewee (in transport equipments) suggested that the company applied only “effective technologies” (called “effective patents”) which were “unavoidably essential for its rivals to manufacture and sell their end products”. The approach led to its decreased applications. He emphasized that the capability to develop an end product as well as new technologies was equally important.

as “*customer relationship management*” and “*long-term contracts*” unexpectedly does not have larger strategic value. These findings are consistent with the results of Goto *et al.*[1996]’s survey conducted in 1995, and are very likely to reflect that the samples are in manufacturing sector.

Certainly, many samples (patent-intensive firms) tend to apply more patents, although difference among firms is large. The motives for patent application are the next important issue. The second question is concerned with the motives problem. The results for the question are shown in Table 3. The respondents were asked on the importance of ten possible motives. The responses suggest that “*Protect own technologies from imitations*” (mean score 4.59) and “*Increase own company’s value*” (mean score 4.05) are very important, being followed by “*Prevent patent infringement litigations*” (mean score 3.96), “*Impede rivals’ patenting strategies*” (mean score 3.76), and “*Improve inter-firm negotiations*” (mean score 3.59). These results are only a confirmation of the traditional rationale of patent system. As the selected motives are overlapping each other in the contents, it can be concluded that the main motive is to protect own technologies from rivals, and keep or improve competitive advantages.

Table 3 Motives to Apply for Patent

| Motives   | Rating of Importance |     |        |      |           | Mean |
|---|----------------------|-----|--------|------|-----------|------|
|   | very low             | low | medium | high | very high |      |
|   | 1                    | 2   | 3      | 4    | 5         |      |
| ① Protect own technologies from imitation                               | 2                    | 2   | 2      | 20   | 66        | 4.59 |
| ② Increase own company's value  | 3                    | 1   | 18     | 36   | 34        | 4.05 |
| ③ Prevent patent infringement litigations                               | 3                    | 3   | 21     | 32   | 32        | 3.96 |
| ④ Impede rivals' patenting strategies                                   | 3                    | 6   | 28     | 28   | 27        | 3.76 |
| ⑤ Improve inter-firm negotiations                                       | 2                    | 9   | 33     | 29   | 19        | 3.59 |
| ⑥ Gain licensing revenues   | 7                    | 23  | 37     | 17   | 8         | 2.96 |
| ⑦ Gain a better bargaining position in standard setting                 | 6                    | 32  | 37     | 11   | 4         | 2.72 |
| ⑧ Prevent rivals from integrating own technologies in a formal standard | 8                    | 20  | 28     | 18   | 17        | 3.18 |
| ⑨ Improve own position in joint R&D                                     | 3                    | 11  | 40     | 29   | 8         | 3.31 |
| ⑩ Improve the technological image of a company                          | 3                    | 10  | 36     | 31   | 11        | 3.41 |

On the other hand, some motives relevant to standardization are less important than expected: “*Gain licensing revenues*”, “*Gain a better bargaining position in standard setting*”, and “*Prevent rivals from integrating own technologies in a formal standard*”.

Finally, we are interested in evaluation about patent strategies of own firms. The question is “*To which extent have your company’s patent policy (patenting and licensing) been successful?*”. The result is: 3 responses for “*very large*” (scale 5), 22 for “*large*” (scale 4), 49 for “*medium*” (scale 3), 15 for “*small*” (scale 2), and 3 for “*very small*” (scale 1). Then, “scale 3” (*i.e.*, “*medium*”) outranks “scales 4 & 5” (*i.e.*, “*large*” and “*very large*”) in mention. The samples with higher evaluation (= “*very high*” and “*high*”) are 25 responses, and 53% (49 responses) of the samples selected “*medium*”. The mean mention rate of 3.07 reflects the distribution as well.

Thus, overall and bearing in mind the qualifications of the questionnaire survey, we can conclude that the persons have well understood the functions of patents, but that the effects are evaluated to be largely of a medium level. Put alternately, they have small or medium perception of patents as strong strategic weapon. The conclusion is consistent with the accepted hypothesis that Japanese firms frequently do not establish the process to manage innovation.

#### **IV Results from the Questionnaire: Standardization Management**

This survey includes many questions. The results are examined in turn as follows.

##### **IV.1 Awareness of Strategic Importance of Standardization**

First of all, we are interested in respondents’ awareness and understanding about the importance of standardization in strategy-makings. To capture and confirm an awareness among firms of the backgrounds promoting standardization, the respondents were asked to rate the importance of some possible statements. The statements are, 1) “*A company has no capability to develop all relevant essential technologies*”, 2) “*A product is of a structure which integrates a greater number of different essential technologies*”, 3) “*A market is not likely to be created and expanded due to plural competing formats*”, and 4) “*Regulatory standards concerning safety, health and environments are socially emphasized*”. The result is shown in Table 4.

Although they attached to each statement an above-“*medium*” level of importance (scales 3, 4 and 5), there is no remarkable common rating, since it was often “scale 3” (*i.e.*, *medium* importance) or “scale 4” (*i.e.*, more than *medium*) that received the largest number of mentions. Among them, the second (mean score 3.45) and forth (mean score 3.47) statements have a little high support. It should be noted that the responses may be affected by characteristics of relevant technologies such as “cumulative” and “combinative” technologies. In conclusion, many respondents

understand the implications from complicated technological structure of a product (*i.e.*, ill influences from “patent thickets”) and increasing importance of “social standards” as driving forces of standardization.

By the way, in particular, when own patents are involved in a “patent thicket”, a firm can not easily realize the effects. In electronics, essential technologies for their complete functionality are dispersed among many patent holders, and are owned by different patent holders. The fact suggests that there is a larger number of licensor and licensee and also of patent. As a result, individual patent holders can not successfully commercialize their own technologies independently. Many relevant firms must coordinate the dispersion of patents. The effects of patents are achieved through standardization processes as coordination mechanism.

Table 4 Backgrounds Promoting Standardization

| Statements  | Rating of Importance |     |        |      |           | Mean |
|---|----------------------|-----|--------|------|-----------|------|
|   | very low             | low | medium | high | very high |      |
|   | 1                    | 2   | 3      | 4    | 5         |      |
| ① A company has no capability to develop all relevant essential technologies                        | 3                    | 22  | 23     | 20   | 7         | 3.08 |
| ② A product is of a structure which integrates a greater number of different essential technologies | 1                    | 18  | 17     | 27   | 14        | 3.45 |
| ③ A market is not likely to be created and expanded due to plural competing technologies            | 7                    | 15  | 18     | 26   | 11        | 3.25 |
| ④ Regulatory standards concerning safety, health and environments are socially emphasized           | 3                    | 10  | 26     | 24   | 14        | 3.47 |

Standardization has always been a very controversial field of activity, since, as suggested earlier, standards do not only involve some economic benefits, but also at the same time reduce individuality and differentiation. As a result, the final effects of standardization vary from firm to firm because of two reasons. First, standardization may induce more competition through increasing homogenization of products, which is likely to have a positive or negative effect on individual profitability. Second, the final effect in a firm includes the profits of the “competition area” (which capture the “indirect” benefits of standardization, and therefore individual competitiveness) as well as the profits of “non-competition area” (which capture the “direct” benefits of standardization).

Thus, evaluation of standardization effects may be expected to be different among firms with different competitiveness and market positions<sup>(6)</sup>. Industrial organization studies have not worked less extensively on the empirical or quantitative assessment of standardization effects, in particular in Japan. It may be due to the unavailability of statistical information at a firm and industry level.

Now, we will refer to the qualitative evidence on the evaluation of standardization effects. The results are concerned largely with: 1) its effects on individual competitiveness and competitive advantage, 2) motives of joining standardization organizations, 3) barriers to standardization, and 4) internal systems for standardization. The results for the questions, shown in the following tables, are likely to reflect the possible evaluation by respondents of standardization effects.

## IV.2 Evaluation of Standardization Effects

The first issue is concerned with the evaluations on the effects of standardization on a company's competitiveness in both the major (with largest sales currently) field and the growing field (as future growth base) in a company<sup>(7)</sup>. The results are revealed in Table 5 (② and ③). In the both fields, more than half of the respondents do not think that standards have or will have an influence on competitiveness: 48 responses (out of 92 available samples in the major field) and 47 responses (out of 91 available samples in the growing field) respectively agree with the evaluation that standardization benefits are *low* (scale 2) or *very low* (scale 1), suggesting that "there is a little or no relation between a company's competitiveness and standards". The findings are roughly in accordance to the results (which is not included in the table) from the evaluations on the effects of standardization on technological development for the ensuing years after standardization.

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<sup>(6)</sup> For example, it is frequently said that the positive effects of standardization on firm profitability have disappeared within 2 or 3 years after standardization in many industries.

<sup>(7)</sup> Doi *et al.* [2010] suggest that in digital camera industry price-cost margin significantly increased after standardization, implying the possibility of profits-raising effect through market expansion and cost reduction by standardization. Similar effects can be found in other industries as well. On the contrary, many industries are found to have incurred profit reduction due to more fierce competition through standardization. Therefore, the effect of standardization may be ambivalent, depending on market structure and competition.

Table 5 Evaluation on Standardization Effects

| Problems   | Standardization Benefits |     |        |      |           | Mean | No response |
|--|--------------------------|-----|--------|------|-----------|------|-------------|
|  | very low                 | low | medium | high | very high |      |             |
|  | 1                        | 2   | 3      | 4    | 5         |      |             |
| ① General View:                                      |                          |     |        |      |           |      |             |
| All responses  | 11                       | 23  | 29     | 16   | 5         | 2.77 | 10          |
| In chemicals   | 5                        | 8   | 5      | 3    | 0         | 1.71 | 6           |
| In machineries                                       | 2                        | 9   | 11     | 10   | 4         | 3.14 | 1           |
| ② Evaluation for a company's largest sales business  | 26                       | 22  | 27     | 9    | -         |      | 9           |
| ③ Evaluation for a company's future growing business | 19                       | 16  | 38     | 9    | -         |      | 11          |

Note: no scale 5 (*i.e.*, “*very high*”) in both questions ② and ③.

Also, respondents were asked about their “general” evaluation on standardization effects from their learning and experiences in their tenure (see ① in Table 5). The evaluations are widely divided; 34 responses suggest “*very low*” and “*low*” effect (scales 1 & 2), 29 responses the effects of a “*medium*” level (scale 3), and 21 responses “*large*” and “*very large*” effects (scales 4 & 5). The breakdown by industry of 21 responses with higher evaluation is: 2 for fiber & textile, 3 for chemicals, 1 for stone & clay, 1 for steels, and 14 for machineries. The finding of diversified distribution is consistent with the above results, and also with theoretical prediction referred to earlier.

But at the same time, the distribution by industry of responses should be noted, since the evaluation, as suggested earlier, may be dependent on the characteristics of relevant technologies, and therefore of industries. In fact, in chemicals with vertically progressive innovations, there are more responses with lower evaluations (*i.e.*, scales 1 and 2). On the other hand, in machineries which tend to combine plural technologies, relatively more responses support the view of “larger standardization benefits” (*i.e.*, scales 4 and 5), although there is a large disperse in evaluation from scale 1 to 5. Therefore, in particular in machineries, standardization is very important for implementing innovations.

Also interestingly, it is noted that the respondents with “high evaluation” emphasized the effectiveness of *de facto* standards and regulatory (therefore, compulsory) standards. According to the result, the most effective standard is 14 cases for *de facto* standards, and 17 cases for regulatory standards for the major field (44 cases), and is 18 cases for *de facto* standards and 14 cases for regulatory standards for the growing field (44 cases). In particular, it is worth noting that regulatory standards have a high evaluation. These findings seem to imply reversely that SSO-based standardization may have lower evaluation.

Thus, we can conclude that there is a wide variation on the evaluation of standardization effects (*i.e.*, from scales 1 to 5), and that many firms have a lower evaluation for standardization.

### IV.3 Participation in Standardization: SSOs

The second issue is about the motives of joining SSOs<sup>(8)</sup>. SSOs here involve 3 major forms. First, there is a “formal” organization which has a government-related accreditation or a formal relationship to a government. The typical example is *ISO* and *IEC* at an international or regional level, and the *Japan Standard Association* (JSA), *ANSI* (US) and *CEN & CENELEC* (EU) at a national level. The second is a “semi-formal” organization that although it is of an “informal” type in that it has no above-mentioned “formally-direct” accreditation or relationship, is usually accredited by the national formal organizations. These two types of organizations have a similar governance and management structure. Finally, there is an “industry consortium” such as patent pool and forum which likewise is “informal” in the above meaning, and is a voluntary specialized organization. Most of the consortia also are run on a similar rule base to the formal or semi-formal SSOs. In this questionnaire survey, the “formal” process means both formal and semi-formal SSOs referred to here, while the “informal” processes involve industry consortia.

Although practically many firms participate in those consensus organizations, the organizations are generally provided lower evaluations. Such evaluations may be reflected in the motives of joining SSOs. Table 6 describes the results from looking at the motives.

The most important motive is “*Exert an influence on the specification of standards*”(① in the Table 6) for both formal and informal organizations, though not overwhelming. But, the motive of “*Utilize own IPR through standardization*” (⑭) is not strong, suggesting that firms don’t prefer to intrude own patents in rivals.

On the other hand, the reasons related to rivals and other companies have no perceived or clear finding; “*Prevent rivals’ specification*”(②), “*Observe rivals’ technological know-how*”(③), “*Increase technological ‘going-ahead’ advantage over non-participants*”(④), “*Increase advantage of technological know-how over non-participants*”(⑤). It is often said that one of the features of Japanese business persons is that they don’t express their intention to outmaneuver or circumvent rivals

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<sup>(8)</sup> SSOs have different classifications, depending on the definition. This study is based on Gunawardena [2007].



as social virtue. These findings may reflect such feature.

Table 6 Motives to Join SSOs

| Motives  | Rating of Importance |             |          |               |             |          |
|--|----------------------|-------------|----------|---------------|-------------|----------|
|  | Formal SSOs          |             |          | Informal SSOs |             |          |
|  | high<br>3            | medium<br>2 | low<br>1 | high<br>3     | medium<br>2 | low<br>1 |
| ① Exert an influence on the specification of standards                 | 29                   | 29          | 16       | 25            | 25          | 23       |
| ② Prevent rivals' specification  | 15                   | 33          | 27       | 22            | 32          | 22       |
| ③ Observe rivals' technological know-how                               | 12                   | 28          | 35       | 21            | 23          | 24       |
| ④ Increase technological 'going-ahead' advantage over non-participants | 22                   | 22          | 30       | 27            | 23          | 24       |
| ⑤ Increase advantage of technological know-how over non-participants   | 23                   | 23          | 28       | 8             | 22          | 24       |
| ⑥ Reduce R&D expenses  | 5                    | 33          | 36       | 7             | 31          | 35       |
| ⑦ Improve productivity   | 10                   | 29          | 34       | 6             | 28          | 40       |
| ⑧ Improve sales  | 10                   | 22          | 37       | 7             | 28          | 39       |
| ⑨ Reduce transaction costs   | 2                    | 28          | 44       | 3             | 24          | 47       |
| ⑩ Promote compatibility with suppliers of complementary products       | 4                    | 28          | 42       | 3             | 29          | 42       |
| ⑪ Ensure legal security on the introduction of new technologies        | 20                   | 33          | 22       | 13            | 33          | 29       |
| ⑫ Enhance bargaining power against suppliers                           | 11                   | 27          | 37       | 9             | 26          | 39       |
| ⑬ Strengthen the cooperation with rivals                               | 15                   | 36          | 23       | 13            | 37          | 24       |
| ⑭ Utilize own IPR through standardization                              | 14                   | 33          | 29       | 17            | 32          | 28       |

Next, an interesting finding is that the performance measures of standardization effects are not a significant motive. “*Reduce R&D expenses*”, “*Improve productivity*”, “*Increase sales*”, and “*Decrease transaction costs*” all are of lower importance as participation motive. These results are consistent with lower evaluation of standardization effects referred to above. These results may suggest that firms can not sufficiently understand the economic mechanism and benefits of standards and the strategic relations between standardization and business behavior.

Third, other reasons also have no clear distribution of response, or have relatively lower importance. The following statements may be rather of a higher importance: “*Ensure legal security concerning the introduction of new technologies*” (⑪) and “*Promote the cooperation with rivals*” (⑬).

Thus, most of the possible motives for joining SSOs are rather unclear or weak in mention. Therefore, firms may not join standardization processes such as SSOs with clear strategic objectives. And, there is no large difference in motives between formal and informal organizations.

#### IV.4 Barriers to Standardization

Participation in standardization processes may be affected by restrictive factors, which are called “barriers to standardization”. We have to look at what prevents firms from participating in the processes actively. Respondents were asked to rate the importance of the following ten possible barriers which were related to within-company factors and problems facing SSOs: 1) “*Lack of awareness by researchers and engineers*”, 2) “*Inflexible SSOs*”, 3) “*Very short product cycles*”, 4) “*High costs of participating in standardization process (such as personnel wages and business travel costs)*”, 5) “*Insufficient protection of IP*”, 6) “*Too many patents impede selection of technologically optimal standards*”, 7) “*Relevant technologies are hold by many different patent holders*”, 8) “*Insufficient communication and coordination between technology and standardization-related divisions within a company*”, 9) “*Insufficient capabilities of negotiation (including English language) by experts*”, and 10) “*Lack of awareness by top management about standards*”.

The result is a little puzzling, since Table 7 shows no discernible pattern on the distribution in mention: the most important barriers can not be found from the results. Also, when interviews with business managers were conducted before this survey, some interviewers suggested that insufficient internal understanding of standardization might be a significant barrier. But, the results are beyond the *a priori* expectation. The respondents attached to each factor an “above-*medium*” level of importance (scales 3, 4 and 5), implying that these factors may be combined to play some barriers. In particular, it is found that the results about SSOs are consistent with the often-cited critique that standardization process through a SSO is slow, costly and inflexible. An interviewee emphasized that SSO-based standardization is of “a long, complicated and burdensome process”.

It is also noted that these evaluations may depend on the evaluations on standardization effects. In other words, these evaluations about the barriers’ importance are likely to reflect the finding confirmed earlier that the respondents tend to have a relatively low evaluation of standardization effects. The barriers’ evaluation may be dependent on the scope of standards as well.

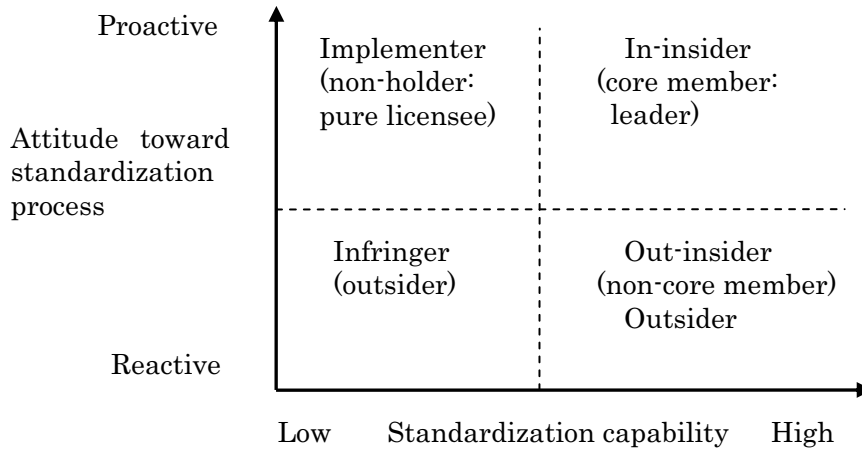
Table 7 Barriers to Standardization

| Barriers   | Rating of Importance |     |        |      |           | Mean |
|--|----------------------|-----|--------|------|-----------|------|
|  | Very low             | low | medium | high | very high |      |
|  | 1                    | 2   | 3      | 4    | 5         |      |
| ① Insufficient understanding by Researchers & engineers                                | 2                    | 15  | 32     | 21   | 3         | 3.11 |
| ② Inflexible SSOs  | 3                    | 12  | 35     | 18   | 4         | 3.11 |
| ③ Very short product cycle   | 9                    | 20  | 27     | 12   | 5         | 2.82 |
| ④ High costs of standardization  | 3                    | 7   | 30     | 29   | 4         | 3.33 |
| ⑤ Insufficient IP protection   | 4                    | 12  | 32     | 23   | 2         | 3.10 |
| ⑥ Many patents impede selection of technologically optimal standards                   | 8                    | 15  | 25     | 21   | 5         | 3.00 |
| ⑦ Relevant technologies are shared by many patent holders                              | 5                    | 10  | 27     | 23   | 9         | 3.28 |
| ⑧ Insufficient coordination between technology and standard divisions within a company | 4                    | 19  | 30     | 15   | 5         | 2.97 |
| ⑨ Insufficient capability of negotiation of personnel                                  | 6                    | 12  | 31     | 21   | 3         | 3.04 |
| ⑩ Lack of awareness by top management  | 6                    | 15  | 30     | 21   | 2         | 2.97 |

In addition, some respondents indicated their comments on these questions at the end of the questionnaire sheet. It was that the “free-riding” problem may have an influence on the incentive to participate in standardization process. Similar comments were suggested by some interviewers as well.

In general, the stakeholder firms in SSO-based standardization consist of four subtypes: formal core members (sponsors and leaders), formal non-core members (observers), implementers (licensees), uninvolved outsiders, and infringers. Figure 3 classifies SSO stakeholders into the four subtypes, following the two criteria of “attitude toward standardization process” (“*proactive*” to “*reactive*”) and “standardization capability” (“*high*” to “*low*”). The latter criterion picks up largely the holdings of essential patents; Firms with “*low*” standardization capacity usually have no essential patent (*i.e.*, non-holder). The figure also suggests a matrix of SSO stakeholders.

Figure 3 Stakeholders in SSO-based Standardization



The possible free-riders consist of two major types: formal non-core members and non-members as infringer (IPR ignorer). The former type of free-rider, who is called “out-insider” here, joins the consensus process, but do not actively participate in the process, and can free-ride on the investment in infrastructure and education & training of leading core members (that is, “in-insider” here) at less transaction costs. Also, in an earlier stage of market growth, the out-insiders can learn from the in-insiders’ successes and failures and gain a competitive advantage by supplying better products and services which reflect their learning.

One interviewee also implied that the “out-insider” problem might be influential in standardization processes. The out-insiders may strategically defer the standardization process, and gain benefits from production with no standard until the completion. One of the out-insiders is a firm engaged in the so-called “patent-holdup strategy” referred to later. Unfortunately the free-riding problem was not included in the questionnaire. The problem has not been examined in existing studies as well, but certainly is among the crucial problems in economic analysis. Put alternately, the relation between an SSO and its members (including potential members as well) should be analyzed.

#### IV.5 Evaluation on SSOs’ Governance and Management

Many companies join SSOs. For example, in growing (strategically most important) fields, out of 80 available samples, 47 firms join SSOs, while 33 firms do not join. And out of 47 participants, 36 firms are a “formal core member”, and 11 firms a “formal non-core member”.

Therefore, SSOs’ governance and management may have an influence on

standardization processes. In other words, how to govern and manage a cooperative organization is a big issue, which is usually called “cooperative governance and management”<sup>(9)</sup>. Some relevant questions are discussed here.

The respondents in Table 7 provide an “above-*medium*” or “above-*high*” level of agreement for the statement of “*Inflexible SSOs*”. Put alternately, SSOs are predicted to have no high evaluation as coordination mechanism. In fact, as Table 8 suggests, *difficult coordination of IPR* is a big issue in the governance of SSOs. Also, “*Limited membership*” and “*Coordination between an SSO and own company*” are an “above-*medium*” level of qualification in standardization process. From the result, a delegate from a company is frequently found to face pressure from both his own company and SSO.

Table 8 Governance Problems in SSOs

| Problems                        | Rating of Importance |     |        |      |           | Mean |
|---------------------------------|----------------------|-----|--------|------|-----------|------|
|                                 | very low             | low | medium | high | very high |      |
|                                 | 1                    | 2   | 3      | 4    | 5         |      |
| ① Coordination of IPRs          | 5                    | 8   | 21     | 28   | 14        | 3.57 |
| ② Qualification of membership   | 4                    | 13  | 42     | 15   | 1         | 2.95 |
| ③ Coordination with own company | 5                    | 10  | 36     | 21   | 4         | 3.12 |

Certainly, we have some concrete examples of governance failure<sup>(10)</sup>. For example, *Covisint* (the *Connectivity, Visibility, Integration*), a US-based SSO for e-commerce of automotive parts and components, broke up into two groups due to the conflict of interests between major OEMs (assemblers) and suppliers. The OEMs had run the SSO, emphasizing largely their own benefits. Also, standardization working of the new generation of automotive LAN is deferred in *JasPar*, a Japan-based SSO for the format and an equivalent of Europe’s *AUTOSAR*. The major reason is the “integral” management of the SSO. In fact, the completion of the next generation format has been delayed, and is far in the rear of Europe. Therefore, the governance and management of SSOs are likely to affect standardization processes. As Doi [2010] emphasizes, the structure, behavior and performance of SSOs are a big issue to be examined as one of possible determinants of standardization.

#### IV.6 Internal System of Standardization

<sup>(9)</sup> See for example Theurl [2005] for cooperative governance and management from the viewpoint of transaction cost theory.

<sup>(10)</sup> See Doi *et al.*[2008] and the *Nikkei Business Daily*, June 12 2009, p.11.

Finally, the participation and effects of standardization may depend on internal system of standardization in a company. The system includes both organizational structure and manpower.

The respondents were asked on whether a company had a regular unit (hereafter special unit) with full-time responsibility for standardization. Only 29 companies out of 86 available responses have a special unit. The breakdown is; 2 for textile, 7 for chemicals, 16 for machines, and 1 respectively for lubber, steels, metal products, and others. Therefore, the result reflects larger technological imperativeness in chemicals and machines. On the other hand, 54 out of 57 companies with no special unit replied that they would not plan the new starting-up of the unit. Therefore, there are a small number of companies with organizational operation and strategy-making in Japan. At the same time it should be noted that the introduction of a special unit may be affected by company's product configuration as well.

The organizational structure at a non-executive level is generally consistent of department (the "*Bu*" in Japanese), section (the "*Ka*"), and subsection (the "*Kakari*"). Usually there is the following positioning of operational power:  $Bu > Ka > Kakari$  in power structure. Any one of those units is responsible for standardization works, but a company with the "*Bu* of standardization" is more likely to attach great importance to standardization than any other types. Therefore, the perception for importance of standardization strategy may be captured through the organizational positioning of relevant units in a company.

Out of 29 companies with special unit, the distribution in mention is 9 companies for the *Bu* type, 13 for the *Ka* type, and 7 for the *Kakari* type. The distribution is dispersed. And, concerning the organizational relationship between the standard and IP units, the former organization is within IP unit in 3 companies, and is independent of IP organization in 26 companies. Some progressive companies have a task force for strategically promoting standardization. For example, some electronics companies have set up the independent and strategic force, of which the role is to formulate standardization strategies, and promote internal understanding through education and information collection. But, organizational structure may be different among firms, depending on product composition and diversification<sup>(11)</sup>.

Also, various studies and knowledge such as technologies, management and law

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<sup>(11)</sup> When looking at organizational structure of major companies, unit for standardization is called as various names such as "standard department", "office of standard strategy", "standardization & collaboration center", and "standard & partnership department".

are necessary as infrastructure for strategy-makings. In other words, qualified personnel are essential. But, many companies do not have formal learning and training programs for current and potential experts, leaving learning and training to standard-related personnel themselves.

These findings for internal institutional problems are very likely to reflect the weak evaluation of standardization effects found earlier. It is vital to increase the understanding and awareness of the standardization benefits.

## V Results from the Questionnaire: Interaction between IPRs and Standardization

The final question is devoted to the link between IPRs and standard managements. The standardization process is likely to be related to the IPR management, and in particular possible litigation. Recently IPR litigations tend to be decreased<sup>(12)</sup>. The fact very likely reflects that cooperation with rivals is dispensable for implementation of patents because of patent thicket, although there remains the possibility that major firms tend to refrain from applying patents, preferring secrecy to disclosure of new inventions. These certainly are both recent discernible trends.

However, consensus-based standardization does not always mean that there is no IPR conflict. Respondents were asked on “*whether they experienced in particular strong conflicts with their own and others’ IPRs among participants of the standardization process*”. The results suggest from Table 9 that many companies were not involved in strong conflicts in patents, trademarks, copyrights, and trade secrets. It is difficult to say definitely that these results are of an abnormal distribution, but at least it may be concluded that many firms prefer peaceful settlements to burdensome infringement suits. The fact suggests that IPR coordination is either of a peaceful and speedy process or inversely of a “conflict-full” and slow process.

Table 9 Fierce IPR Conflicts in Standardization Processes

| IPRs         | Rating of Importance |           |            |                         |           |            |
|--------------|----------------------|-----------|------------|-------------------------|-----------|------------|
|              | Concerning Own IPRs  |           |            | Concerning Others' IPRs |           |            |
|              | No                   | Sometimes | Frequently | No                      | Sometimes | Frequently |
|              | 3                    | 2         | 1          | 3                       | 2         | 1          |
| ① Patents    | 64                   | 17        | 1          | 58                      | 22        | 2          |
| ② Trademarks | 78                   | 6         | 0          | 77                      | 7         | 0          |
| ③ Copyrights | 78                   | 6         | 0          | 78                      | 6         | 0          |
| ④ Secrecy    | 78                   | 6         | 0          | 79                      | 5         | 0          |

<sup>(12)</sup> The new litigations concerning both patents and utility models during 1999 to 2008 are: 126 cases (1999), 133(2000), 108(2001), 129(2002), 141(2003), 143(2004), 125(2005), 102(2006), 124(2007), 101(2008). See Japan Patent Office’s *Annual Report* (various years).

And, turning to specific contents of conflicts, there are a great number of responses who replied that the company had not experienced “*Sharp conflicts in FRAND (fair, reasonable, and non-discriminatory) conditions of licensing*” (69 out of 81 available responses), deceptive “*hold-up (patent ambush) strategy by rivals*” (70 responses), “*Being filed infringement suits against by others*” (51 responses), and “*File infringement suits against others*” (59 responses). Hold-up may take place in case where “a firm improperly induced an SSO to adopt a standard incorporating the firm’s IP without properly disclosing that the firm owned these IPRs” (ABA [2004], p.60).

But, it is worth being noted that 11 (hold-ups) and 12 (licensing conflicts) companies have experienced respectively the hold-up and fierce licensing conflict problems frequently or sometimes. Those companies are largely in machineries and in particular in electrical appliances. For example, the hold-up has been experienced by 5 firms in electrical appliances, 2 firms in chemicals, and 1 firm respectively in fiber & textile, non-ferrous metals, metal products, and transport equipments.

Some studies (for example Sidak[2009]) emphasize that hold-up scarcely takes place in real-world industries. But, the present results suggest that these strategies are not a theoretical artifact in an antitrust model, but are among important practical economic issues in public IPR and competition policies. In fact, the possibility of the strategies can be found in the *Rambus* antitrust case in US and EC (2006 to 2009)<sup>(13)</sup>. Therefore, the contents of the FRAND conditions and holdup strategy should be analyzed from the economics viewpoint, which are crucial for IPR antitrust cases. It is no wonder to focus on and intensively examine these problems as antitrust issue in economic analysis.

Next, respondents were asked on “*which type out of the following methods is the most preferable in IPR coordination in standardization process: Patent pool, Cross licensing, Non-assertion agreement of IPRs (which is sometimes called “non-assertion covenants (NAC)”)*, *formal SSOs* and *de facto standardization*”. They suggest that non-“formal SSOs” methods such as “*Patent pool*” (28 responses), “*Cross licensing*” (18 responses), and “*Non-assertion of IPRs*” (15 responses) are better than *formal SSOs* (18 responses) and *de facto standardization with refusal to license* (0 response). In particular, it is noted that many respondents propose patent pools<sup>(14)</sup>. It may be because they think that patent pools are likely to be strategically flexible. Additional reason is that leaders with essential patents may restrict “reactive” behavior of out-insiders and outsiders through pools. Patent pools are frequently utilized in

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<sup>(13)</sup> See EC [2009], Updegrave [2009] and Suzuki [2010] for the case.

<sup>(14)</sup> Some patent lawyers frequently indicate that recently Japanese firms are increasingly interested in patent pools.



electronics and software sectors, but pools may be useful for other sectors (such as automobile with an increasing number of electronic devices, and biotechnology and nanotechnology with possible patent thickets) as well. In this cense, a study of patent pools is important.

This result also is consistent with the above-mentioned finding that the respondents see SSOs as less useful for standardization process. In addition, the IPR non-assertion is unexpectedly preferred<sup>(15)</sup>. It is important to theoretically and empirically examine the choice of governance structures in standardization and patent coordination, and their respective economic effects.

Finally, IPR coordination is frequently very difficult in formal standardization process as well. In those cases, alternative solutions have been proposed; for example, “*compulsory licensing*” and “*relaxed conditions of patenting*” (such as reduced terms). The importance of these institutional solutions was asked. These measures, as suggested in Table 10, do not display remarkable cluster of responses, but both gain an “*above-medium*” level (scales 3, 4 and 5) of agreement. The latter (70 out of 78 available responses: 90%) is rather more preferable than the former (54 out of 77 available responses: 70%).

Table 10 Alternative Solutions for Patent Conflicts Governance Problems in SSOs

| Solutions                         | Rating of Importance |     |        |      |           | Mean |
|-----------------------------------|----------------------|-----|--------|------|-----------|------|
|                                   | very low             | low | medium | high | very high |      |
|                                   | 1                    | 2   | 3      | 4    | 5         |      |
| ① Compulsory licensing            | 7                    | 16  | 28     | 21   | 5         | 3.01 |
| ② Relaxed conditions of patenting | 3                    | 5   | 35     | 29   | 6         | 3.38 |

However, if scales 4 (“*high*”) and 5 (“*very high*”) capture the evaluation of an adequate solution, there is a rather divided evaluation for the compulsory licensing; respondents (23 persons with scales 1 and 2) who don’t support it are responsible for roughly 30%. Therefore, many respondents take a skeptical view of the measure. On the other hand, more respondents support the relaxation of patenting conditions. Thus, many firms may prefer voluntary or informal solutions to institutional or compulsory measures, being skeptical of public interventions.

## VI Concluding Remarks

<sup>(15)</sup> NAC is explained in Bekkers *et al.*[2006].

To examine the relationships of standardization to technology, IPR and competition policies, it is necessary to empirically analyze and understand the standard behavior of firms. This paper has taken the questionnaire survey, and provided the uni-variate distributions of responses for various questions. The approach frequently does not lead to sensible results, but we believe that the findings here roughly portray a picture of standardization strategy-makings among Japanese firms. Some major features from the questionnaire survey are summarized as follows.

(1) In general, it is said that Japanese firms less actively involve in the standardization process. But, they have a larger perception and understanding of the importance of standardization. This finding is in contrast with unsuccessful activities of Japanese industries in global standardization processes, which are frequently suggested by some case studies. The discrepancy may have an implication.

(2) Recognizing that product innovation and improvement are overwhelmingly important in strategy, firms have stronger preference for patents, trademarks, secrecy and lead-time advantages than for other measures as protection tools of invented technologies.

(3) The important motives emphasized of patent application are: avoiding rivals' imitations, increasing own company's value, preventing infringement litigations, and impeding rivals' patenting strategies. But, the patent and licensing strategies were frequently estimated to be of a medium and less level of success.

(4) There is a diversified evaluation on standardization benefits, depending on technological characteristics of industry and other possible factors. Also, many companies feel a little doubtful of the large benefits of standardization. The lower evaluation may be related to the assessment that standardization through SSOs has not always sufficient effect..

(5) The important motives of joining SSOs are: exerting an influence on the specification of standards. It is noted that the factors picking up the relations with rivals, and also the performance-based measures of standard effects are not a significant one.

(6) Although many firms join SSOs, their evaluations are rather of a low rating, implying that SSOs do not function effectively as coordination mechanism.

(7) There is not always sufficient system of organization and manpower for promoting standardization in many firms.

(8) Many companies tend to think that they would like to avoid litigation suits in standardization process. One of the solutions for patent conflicts is coordination

through SSOs. But, the evaluation for in particular formal SSOs' workings is frequently low. For that reason, many respondents have a larger preference for patent pool (a voluntary, informal SSO) and cross licensing (non-“industry-wide consensus” strategy) when coordination is possible. Their views are divergent on the effectiveness of two possible institutional proposals such as compulsory licensing and relaxed conditions of patenting, when coordination is very difficult.

We have no satisfactory theory and evidence of standardization. The present empirical research may help to delineate the major features of standard strategy in Japanese firms, which in turn are likely to lead to the theoretical development of standardization economics. Such “question-begging” approach is likely to be useful.

The economic analyses of standards have in particular two major significances. First, as suggested earlier, technology standardization has played large role, and is currently playing much more important role in industrial activities. Second, in general a market economy includes “cooperative” coordination mechanism as well as competitive mechanism. As this paper emphasizes, consensus standards are among the cooperative mechanism, and have major influences on economic activity. Therefore, consensus standardization should be examined as one of important, but open, economic problems. The present paper is the first step.

However, there remain some problems to be examined. The results may not capture firms' opinions sufficiently, since the response rate is not high, and the results are mostly indicative. Also, the study did not examine the relationships between the results for various questions. In addition, the contents of the questions were limited; the questions did not include some un-negligible factors such as free-riding and antitrust policy<sup>(16)</sup>. Not analyzed were the relationships of the characteristics derived from the questionnaire to the quantifiable factors like R&D measures and financial performance, and further to market structure of industries firms (and respondents) inhabit. Finally, the functioning of SSOs remains open problem<sup>(17)</sup>. The examinations of these problems are left to additional papers.

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<sup>(16)</sup> Standardization may have antitrust concerns, since the processes through formal, semi-formal and informal SSOs have been subject to the review of competition policy offices. See for example ABA[2004], Carrier[2009] and Doi [2009, 2010].

<sup>(17)</sup> See Doi [2010] for the economic analyses of SSOs.

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