

6 Study on Promotion of Use of Patent-related Statistics

The "Intellectual Property Strategic Program 2004," which indicates concrete measures toward making Japan an "intellectual property-based nation," desires that comprehensive and interdisciplinary research on intellectual property (IP) be promoted based on various approaches including law, technology, and economics, and that the IP-related statistics, which serve as the basis for planning and proposing IP policies, will continue to be broadly utilized to help develop policies that meet diverse user needs.

As a follow up to the "Economic Analyses of Statistical Data Relating to Patents" of the previous fiscal year, this report contains the empirical analyses of corporate IP activities based on the Survey of Intellectual Property-Related Activities implemented by the Japan Patent Office (JPO). In this report, study was made to identify clearer relationships between a company's IP activities and the characteristics of the company's industrial field, technical field, as well as products, while giving consideration to the status report of IP activities by the persons responsible in the IP divisions of manufacturers. Furthermore, the report proposes indices for showing the status of IP activities and discusses future tasks for promoting use of patent-related statistics.

I General Remarks

The Institute of Intellectual Property's Study Council on Patents and the Economy for fiscal 2004 made economic analyses of the IP activities of Japanese companies and the trend of technological innovations, based on the Survey of Intellectual Property-Related Activities that elucidates corporate activities related to IP rights, as an extension to the study in fiscal 2003. This report contains the results of these analyses. In addition, it contains the result of examination on deriving indices of corporate IP activities.

Innovations by companies and countries are now studied extremely actively around the world using IP-related data. The first factor behind this trend is the spread of awareness that innovations are decisively important for the competitiveness of companies and countries. Many people have come to take interest in the sources and processes of innovations. The second factor is the increasing availability of IP-related statistical data, as represented by the Survey of Intellectual Property-Related Activities. Apart from these, patent-related databases are also becoming accessible. Therefore, various analyses can be made by combining such IP-related data and companies' R&D and financial data. The third factor is that it has become easy to use a vast amount of data thanks to the development of computers, software, and the Internet. Based on these various factors, analyses of innovations utilizing IP-related data are rapidly making progress on a worldwide scale.

This report contains the results of the study on innovations based on IP-related data, which was conducted by the members of the study

council consisting of leading researchers in Japan. This type of study is helpful for gaining an in-depth understanding of innovation processes as well as providing a theoretical basis for designing policies or systems related to IP or technology.

II Analyses of IP Activities Based on Patent-related Statistics

1 Patent licensing activities of Japanese manufacturers

Why do companies license out their proprietary technologies to other companies? Patent practitioners in companies often explain that a larger profit can be gained by expanding the size of the market pie and then acquiring a slice of it through licensing rather than monopolizing the technologies. However, no previous theoretical and empirical studies on licensing had focused on this point. Following the study in the previous year's report, which theoretically and empirically analyzed such explanations by practitioners, empirical analyses were conducted in this study by using the individual data of the 2003 Survey of Intellectual Property-Related Activities and by adopting unique estimating methods. The empirical analyses also used a variable corresponding to the speculation that companies tend to cross-license their patents when multiple patents are involved in a single product, which is another factor of licensing.

The results of empirical analyses using a two-sided Tobit model were consistent with such a theory or speculation. Nevertheless, expected results could not be obtained for the IP cost (litigation-related cost), which was used as a

variable of the patent transaction cost. (Akira Goto; Yoshihito Yasaki)

2 Analyses of corporate strategies of trademark use and the underlying factors

In this chapter, the actual situation of corporate brand strategies was analyzed by using companies' trademark-related data. Japanese companies have expanded the variety of their products and increased the number of their brands since the 1980s. Looking at large companies, for instance, the number of brands has increased by 3.12 times over the ten years from 1980 to 1990 according to certain data. Such tendency seems to be more obvious in consumer goods industries such as food, beverages, and home appliances. However, the factors that determine the number of brands owned by a company are not clear.

Therefore, the determining factors for the number of brands were examined in this chapter. The survey matters covered by the Survey of Intellectual Property-Related Activities included the number of trademarks owned, the number of trademarks used, and the number of licenses for other companies' IP rights. Accordingly, the determining factors were analyzed through statistical analyses of the relationships between the number of a company's trademarks used and the characteristics of the industry or the company.

Two major hypotheses were raised. One was whether or not branding is important in that industry. Factors including asymmetry of information, market competition, and technology-based differentiation were taken into consideration. The other was whether a company tends to use an existing brand or develop a new brand when entering a new product market. The attributes of the product were taken into consideration. These hypotheses were verified after controlling the number of products.

As a result of the estimation, the following four points were indicated. Firstly, the number of brands was larger in consumer goods industries. Secondly, looking at the extent of diversification of R&D, large companies that own products with diverse attributes had a large number of brands, but this did not apply to small and medium-sized enterprises (SMEs). Thirdly, the higher the percentage of R&D cost to net sales in the industry, the smaller the number of brands was. However, no significant relationship was observed with the percentage of R&D cost to net sales of individual companies. Lastly, subsidiaries had a smaller number of brands. (Tomoyuki Shimbo; Sadao Nagaoka)

3 Empirical analyses of the compensation system for employees' inventions

In this chapter, an attempt was made to analyze whether the actual patterns of the level of compensation for inventors in companies could be better explained by the incentive hypothesis based on the incentive theory or the regulation hypothesis in which compensation is paid based on a passive reason, i.e., presence of Section 35 of the Patent Law. First of all, the following facts became clear from the results of calculation of compensation cost by company size and by industry. Firstly, the annual compensation cost per R&D employee was the highest for large companies (an average of about 16,000 yen), followed by SMEs (an average of about 11,000 yen), and venture companies (an average of about 9,000 yen). In all cases, however, the cost is considerably low compared to the payment of wages. Although these are average figures, the low level of the figures suggests that the compensation amount is not important as an incentive. Secondly, the larger the number of employees in a company, the higher the compensation cost per R&D employee tends to be. Unlike stock options, the remuneration for an invention is linked to the individual invention of each researcher, rather than the corporate value, so the fact that the compensation is higher in large companies does not necessarily conflict with the incentive hypothesis. Nevertheless, considering that large companies are better equipped with internal systems for responding to regulations, it also complies with the regulation theory. Lastly, the level of compensation cost is higher for industries with a larger number of patents per researcher or per R&D cost. This complies with the regulation theory.

Next, the following analysis results were obtained on the determining factors for the compensation cost by quantitative analyses of corporate-level data. Firstly, the number of patents per unit of R&D cost had a positive and significant impact on the level of compensation cost even after controlling the percentage of R&D cost to net sales. This result supports the regulation hypothesis. Secondly, the amount of compensation became larger, though not significantly, for companies whose average number of years spent from filing until registration is long and which carry high R&D risks. Meanwhile, the amount of compensation did not become significantly large for younger companies. These results comply with the regulation hypothesis.

These analysis results suggest the following. The analyses in this chapter indicate that companies tend to pay compensation for inventions to the inventors due to the presence of

Section 35 of the Patent Law. Therefore, ex post facto intervention by courts concerning Section 35 of the Patent Law, which would further strengthen such a tendency, may impair companies' R&D investment incentives. It is hoped that active discussions will be made from such a viewpoint in the future. (Sadao Nagaoka; Yoichiro Nishimura)

4 Corporate R&D strategies and their effects from the viewpoint of acquisition and use of patent rights

In this chapter, an attempt was made to analyze the determining factors of the utilization rate, which is the percentage of utilized patents to the total number of patents owned, at the corporate level. First of all, the following five hypotheses were presented with regard to acquisition of patents:

- (i) the strength of the appropriability regime backed by complementary assets;
- (ii) quality of inventions;
- (iii) commercialization risks; and
- (iv) licensing-out opportunities.

As pointed out by Nagaoka and Nishimura (2005), the hypotheses from (i) through (iii) focus on two elements: (1) the difference between the quality of an invention at the time of filing the patent application (or at the time of request for examination) and that of the invention in the commercialization phase; and (2) the sunken costs that are borne by the company from the time of the filing until the commercialization phase. According to these hypotheses, the utilization rate is lower for companies with more complementary assets, more licensing-out opportunities, and higher commercialization risk, and the rate is higher for companies that create high-quality inventions.

Next, the above hypotheses were examined using the 2003 Survey of Intellectual Property-Related Activities, and the following analysis results were obtained. Firstly, even after controlling the scale of R&D activities, the utilization rate was lower for companies with more complementary assets though they had a larger number of patents. Secondly, companies that license-out their technologies tended to acquire more patents, but their utilization rate tended to be lower. Thirdly, the utilization rate was lower for companies that spend a longer time from the filing until registration, in other words, companies facing higher commercialization risk. Fourthly, the utilization rate was higher for companies that create high-quality inventions because they acquire many patents as well as use them. Fifthly, the utilization rate was found to be lower for companies with higher price-cost margin, so the conventional view that newcomers

can be deterred by strategically making patents dormant was not supported.

Lastly, the analysis results in this chapter provided a suggestion for the conventional attempt of comprehending R&D efficiency based on the relationship between the number of patent applications filed or patent registered and R&D cost. Specifically, the conventional method could underestimate the existence of unused patents that are not connected to the business income at all, and could overestimate R&D efficiency. It is hoped that companies will plan their R&D strategies and patent strategies based on this finding. (Sadao Nagaoka; Yoichiro Nishimura)

5 Patent value and IP activities

When one intends to comprehend the achievements of a company's R&D activities, patents serve as the most directly observable index. However, it is obvious that merely counting the number of patents owned by the company would be quite insufficient. The simple reason is that individual patents have different values.

The purpose of this chapter is to find a proxy index for comprehending the average value of patents owned by each company by using the Survey of Intellectual Property-Related Activities, which is corporate-level statistical information on patents. Companies are likely to be comparing the additional profits that will arise from maintaining the patent and the annual fee that must be paid to maintain the patent for each of its patents every year, and are maintaining the patents only if the expected profits exceed the annual fee. As a possible proxy index for comprehending the average value of a company's patents in such a case, the average number of years the patents are maintained and the maintenance fee per patent owned can be derived as candidates under a simple model of corporate decision-making on the maintenance of patents. In order to judge which of these two candidates is more appropriate as a proxy index of patent value, a formula that explains the average license fee to be adopted when the company licenses-out its patents was assumed.

Of the two proposed proxy indices, a positive and significant coefficient could be obtained in the estimated formula as expected for the maintenance fee per patent, but no significant coefficient was obtained for the average number of years the patents are maintained. Due to this estimated result, a provisional conclusion could be obtained that, of the two candidates for the proxy index of the average patent value, the maintenance fee per patent owned would be the more appropriate index. (Fumio Funaoka; Joji Tokui; Fumihiko Koyata)

6 Effects of R&D diversification

Many conventional empirical studies on diversification of the business fields have indicated the inefficiency pertaining to diversification. As often indicated, technical knowledge and know-how concerning R&D are difficult to put down in clear writing, so they are not easily traded in the market. This indicates that the economy of scope, which is not clearly found to exist for the diversification of business fields, may be found to exist for R&D diversification.

Two types of empirical analyses were conducted in this chapter. Firstly, a pseudo company was created based on diversification of technical fields from the various indices of R&D activities of companies whose patent applications concentrate in a certain technical field, and comparison was made between the indices of actual companies and those of the pseudo company to examine whether the economy of scope exists.

As a result of the analysis, the economy of scope was significantly observed for the researchers' performance seen from the filing status, the number of applications filed, and the percentage of R&D cost to net sales for all companies.

Secondly, the question of whether the economy of scope can be enjoyed for R&D investment was analyzed based on the impact of the extent of diversification of technical fields to the amount of R&D cost necessary for filing a patent application. As a result of the empirical analysis, the variable expressing R&D diversification was found to be positive and significant. This indicates that the larger the scope of R&D activities, the more the R&D investment per patent application will be saved. It suggests that the economy of scope can be enjoyed for R&D investment.

The finding that the economy of scope exists for diversification of R&D investment indicates that there are more commonly usable assets in an intangible form compared to diversification of goods, and that the spillovers of technical knowledge between the respective R&D fields cannot be neglected. (Fumio Funaoka; Joji Tokui; Fumihiko Koyata)

7 Presumption of the patent production function and comparison between companies

In this chapter, the impact of the differences in the IP strategies, particularly the patent filing strategies, on the corporate market value was empirically analyzed. Generally, however, it is difficult to observe IP strategies from outside and

comprehend them quantitatively. Therefore, in this chapter, a simple national patent production function and a foreign patent production function were assumed by the ordinary least square (OLS) method, and the residuals of the functions were respectively deemed as the proxy variables of the "national patent filing tendency" and the "foreign patent filing tendency." Then, investors' evaluation of the company's IP strategy was empirically examined by regressing Tobin's q of each company against these variables.

With regard to the number of national patent filings, the IP cost and the characteristics of the industry were found to have large impacts on the number of filings, but no correlation was observed between the R&D fee and the number of filings. As for the number of foreign patent filings, foreign filings were found to increase as national filings increased as a result of a regression analysis using the number of national patent filings and the IP-related cost as the explaining variables. Lastly, the determining factors for Tobin's q were analyzed by using the residuals (the national patent filing tendency and the foreign patent filing tendency) obtained from these regression analyses. As a result, the coefficients were insignificant for both the national patent filing tendency and the foreign patent filing tendency, and the impact of a company's patent filing strategy on its market value could not be confirmed. In addition, it was assumed that filing tendency and the corporate value would have a positive correlation in industries with higher appropriability, because the higher the appropriability in the industry, the higher the profits expected from owning patents. However, this hypothesis was not supported either. (Kenta Nakamura; Hiroyuki Odagiri)

8 The impact of complementary assets on unilateral licensing agreements

In the Survey of Intellectual Property-Related Activities, a relatively large number of responses have been gained from SMEs engaged in R&D activities. In this chapter, the individual data of these invaluable responses were used to analyze the status of unilateral licensing agreements by company size and the determining factors for unilateral licensing agreements. The analysis results revealed that, among the SMEs, small companies with 50 or less employees were more actively engaging in unilateral licensing agreements as contrasted with the number of patents they owned. In addition, the proportion of the licensing revenues in net sales was larger for these companies compared to medium-sized or large companies, which indicates the large role played by paid licensing agreements. Also as a result of an empirical estimate that narrowed the

samples to SMEs, companies with a smaller number of employees were found to be increasing the number of their patents to be provided through unilateral licensing agreements. If the number of employees could be deemed as a proxy variable of complementary assets, these results strongly suggest that companies with less complementary assets other than patents are more inclined to conclude unilateral licensing agreements. (Koichiro Onishi; Yosuke Okada)

9 Application of the SWOT analysis framework to the method of identifying the IP strategy pattern

In this chapter, examination was made on identifying the IP strategy pattern by applying the SWOT analysis framework, which is a strategy planning method used in business. The indices required for the identification were calculated based on the 2003 Survey of Intellectual Property-Related Activities, and the dominant strategy in each industry was analyzed using these indices.

The result indicated that, even if different business lines were similarly regarded as "high-tech" industries due to their high R&D intensity, the strategic position of the average companies may greatly differ by business line in response to the internal factors including the intensity of IP activities and external environmental factors including the existence of "opportunities" and "threats" involved with the business line. Therefore, the result suggested that industrial technology policies should be planned out by considering the characteristics of the technology of the individual industries not only from the R&D point of view, but also from the IP activity point of view. The indices by industry calculated in this chapter are also useful for individual companies to discover their position within the industry and decide the direction of their IP strategy. Therefore, it is hoped that the Survey of Intellectual Property-Related Activities will be further utilized in the future as such useful basic data for decision-making. (Akiya Nagata)

10 Corporate IP strategies and innovation activities

In this chapter, indices concerning corporate IP strategies were examined by using the data on the patent utilization status contained in the results of the Survey of Intellectual Property-Related Activities. Some sub-indices directly derived from the survey results and general indices that have consolidated the sub-indices by principal component analyses were obtained. Then, the relationships between these indices

and the respective characteristics of a company including the industrial classification, technical classification, and company size were evaluated. Furthermore, the relationship between a company's IP strategy and R&D activities was analyzed by using the general indices.

As a result of the principal component analyses, three kinds of corporate IP strategies could be identified: (i) an open licensing strategy that actively uses the external technology market through licensing; (ii) a technology provider strategy that mainly licenses out proprietary technology; and (iii) selective licensing strategy that does not actively use the external technology market. Of these, the technology provider strategy is frequently observed among R&D-oriented SMEs that do not have their own management resources such as manufacturing or marketing. Meanwhile, the selective licensing strategy can also be considered to indicate a group of companies whose overall internal IP awareness is low, instead of being a strategy in itself.

With regard to the relationship between these indices and R&D activities, companies adopting an open licensing strategy were found to be making R&D investment more actively, and their investment was found to be focused on specific fields. The analyses revealed that these Japanese companies are effectively utilizing the external technology market in order to focus on their own core technologies and to further strengthen their core capabilities. (Kazuyuki Motohashi)

11 Current situation of analyses of patent-related statistics in Europe and the United States

European and U.S. universities and organizations are also engaged in studies on investigating the forecast of patent filings, policy decision, and patent value through economic analyses of patent-related statistical data. One of the opportunities for internationally presenting the results of these studies is the Workshop on Statistics in the Patent Field jointly held by the World Intellectual Property Organization (WIPO) and the Organisation for Economic Co-operation and Development (OECD).

This chapter explains the outline of the following analyses that were presented in the workshop: the analysis of corporate market value using U.S. references; the analysis of the utilization rate of European patents and their impact on the economy; the analysis of references in Europe; and forecast of the filing trend of European patents. (Masayuki Ode)

12 Relationship between business activities and IP activities

With the aim of clarifying the situation of corporate IP activities, an interview survey was conducted on Japan's four leading manufacturers.

The reason that companies file patent applications and acquire patents for the inventions made by their R&D division instead of protecting them as know-how in their IP activities is likely to be to gain a return on investment and avert market risks (a countermeasure against competitors) through use of the patents. Acquisition of income through licensing is currently not the main purpose of patenting. Therefore, it is desirable for companies to gain licensing income through use of IP, if the licensing does not affect their core businesses and if the licensing makes their business more advantageous in the market such as enlarging the market pie or gaining licensing income for patents related to technical standards. (Masayuki Ode)

13 Analyses of the mechanism of IP activities and the filing trend of Japanese companies

In this chapter, IP activity models were created and analyzed by dividing domestic legal entities such as companies into nine groups based on the filing pattern by technical field and the patent lifetime pattern. The models were created based on 353 companies including the companies that ranked high in the number of patent filings in 2002. There were about 280 classes of technical fields, and the percentage distribution of each company's number of filings by technical field was patternized. With regard to the patent lifetime pattern, the respective time spent up to the filing, examination, and registration as well as their percentage to the number of applications filed were calculated for each company. The filing pattern by technical field and the patent lifetime pattern of each company were separately categorized into multiple groups by way of a cluster analysis, and the patterns were divided into nine groups in the end. Normally, the classification is made based on the business lines of the companies. However, there are differences in the types and the number of technical fields of the inventions, and variations in the average rate of requesting examination or the average patent maintenance period even in the same business line. Thus, the grouping based on the technical field and the patent lifetime was attempted instead.

In creating the models, the following six categories were assumed as indices that have an impact on IP activities: company size; scale of R&D; IP stock; IP activity; IP-related indices; and

IP activity related costs. For each category, the usable indices derived from the 2003 Survey of Intellectual Property-Related Activities as well as the data of final dispositions and patent data provided by the JPO were concretely applied, and variable selection and coefficient determination were conducted by multivariate analyses. When the actual values for 2002 and the estimated values were compared for the nine models, the values obtained were more or less the same. When these models were further compared with the actual values since 1996, all models showed the same trend as the actual values. When the trend in the number of filings up to 2015 was estimated, the number slowly flattened out overall. Therefore, it was estimated that the filing peak around 2001 will propagate slowly because part of the patents become the company's IP stock and influence subsequent patent filings. Seen individually, the number of filings was expected to decline in the future in two groups, which were groups of companies with large R&D costs and relatively short patent lifetime. On the other hand, the number of filings was expected to continue increasing for companies with a high average rate of requesting examination, because more IP stock tends to be accumulated. The created models only indicate the structural relationships between indices at a single point of time, and do not take into consideration the time lags between the number of filings and the respective indices. Furthermore, they replaced the values of IP stock and corporate size for convenience in making the future estimate. In order to improve the accuracy of the estimate and enhance the interpretability of the models, data must also be prepared for the other indices over the years. (Tatsuo Nakamura; Makiko Harada; Yoshihiro Miura)

III Deriving Indices from Patent-related Statistics

1 Corporate IP activities revealed by empirical analyses using patent-related statistics

Part II reports various analyses using patent-related statistics that were examined by this year's study council. The reports, including the report on "technological development, technology transactions, and risks" and the report on "assessing patent value," revealed some relationships between the IP activities of Japanese companies and the characteristics of the companies, such as the industrial classification, technical classification, and company size.

Firstly, the report indicated that technological development and technology transactions inevitably pertain risks, and companies deal with

the risks through technology transactions as an institution or practice.

Next, it was indicated that overestimation of dormant patents should be avoided when statistically assessing patent rights.

Meanwhile, no correlations were found between the patent filing strategy and R&D and between the patent filing strategy and the evaluation of corporate value.

The reports also suggested that, when evaluating corporate patent strategies, the differences between companies' strategic positions (opportunities and risks) and the number of patents licensed out are the major indices that dominate patent strategies.

Lastly, it was indicated that one should evaluate not only patents, but also other complementary assets including trademarks when evaluating corporate IP activities, and that it is possible to evaluate various policies based on the Survey of Intellectual Property-Related Activities, such as the employees' invention system.

2 Ideals and challenges of deriving indices of corporate IP activities from patent-related statistics

The Survey of Intellectual Property-Related Activities, which provides various data on corporate IP activities, is hoped to be utilized as a tool for quantitatively assessing and evaluating corporate IP activities. However, the statistical values could become harmful information if one interprets them erroneously.

In light of the results of this year's research, the most appropriate index is considered to be the number of patents used (the number of patents internally used or licensed out) or the utilization rate ((the number of patents internally used or licensed out)/the number of patents owned).

It is hoped that the impact of comprehensive licensing included in the number of patents used will be analyzed and the interpretability for IP activities other than technology trading will be verified in the future.

3 Future challenges for promoting use of patent-related statistics

Continuous assessment and analyses of corporate IP activities based on the results of the Survey of Intellectual Property-Related Activities are hoped to provide a theoretical basis that is indispensable in discussing Japan's IP policies. With the objective of using this theoretical basis to help the people concerned hold discussions based on common awareness, IP-related statistics should be further expanded and continuously aggregated, while promotion of academic research

using the statistics as well as diffusion and awareness-raising of the research results will also be anticipated.

In addition, analyses should be made not only on patents, but also other intangible assets in order to establish a theoretical basis on corporate IP activities.

Furthermore, it is hoped that economic approaches using IP-related statistics will be applied to technology-specific policy issues (e.g., the problem of the tragedy of the anticommons) in the future.

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