

Potential of Actuarial Approach for Patent Matters – with some topics on Recent Increase of Patent Valuation Needs in Japan -

Makoto Kushibiki

American Life Insurance Company - Japan

AIG Tower 20F, 2-4, Kinshi 1-chome,

Sumida-ku Tokyo 130-8561, Japan

Tel.: +81-3-5619-2218

Fax: +81-3-5619-2684

E-mail: kushibiki@aig.co.jp

30 July 2004

Paper to be presented to the 14th International AFIR Colloquium
(8-10 November 2004 Boston)

Abstract

Recently, it has been stressed that intellectual property should be considered as one of the important elements for enterprises. Among the categories of intellectual property, this paper takes up matters of patent rights and discusses on two topics. First, the recent circumstance in Japan related to patent rights is introduced, which has been developed dramatically these years, with showing the increase of demand of patent rights valuation. Second, I try to show some application areas concerning patent rights in which actuaries can be active from both of theoretical and practical view points.

Introduction

Recently, intellectual property has been focused as one of the important elements that bring profits to enterprises. At the same time, needs of valuation of intellectual property has expanded in various scenes. The use forms of intellectual property are becoming diversified, and there are strong needs of comparing in profitability and in risk potentiality among these use forms. Yet the trading amount is relatively small at now, the patent trading market has been growing. In the near future, financial technologies will have us recognize intellectual properties to be some kinds of investment assets. These circumstances allow us to think that there is a big chance for actuaries to expand their theoretical and practical fields.

In this paper, I will take up only patents, which is one kind of intellectual properties. It could also be interesting to discuss about other kind of intellectual property but I avoid it because there are so many topics in each category of intellectual property.

There are many researches on patent matters and there are many areas to study further concerning them. Various points of view can be considered. For example:

- ✓ Legal study on patent registration system
- ✓ Comparative study of patent system among countries
- ✓ Legal study on patent litigations
- ✓ Writing and interpretation of claims in paragraphs of a patent document
- ✓ Economic study on patent system and technology development
- ✓ Management matters for an technology based enterprise using patents
- ✓ Patent valuation
- ✓ Research on securitization of patent

Additionally, there are the following item from wide aspect:

- ✓ Technology transfer of the fruits of research and development at university
- ✓ Practical know-how on licensing technology
- ✓ Science of inventing processes

While there are a lot of topics as shown in the above, this paper focus into two topics. The two topics are chosen so that actuaries will be interested on the area of patent matters, and so that the topics will be prompts to let some of actuaries get into the area. The first is the introduction of recent increase of patent valuation needs in Japan. The reasons of selecting the first topic are: that there is a big movement in Japan for the direction of expanding patent related activities, and that it is relatively difficult to get information written in Japanese for the English reading people. The second information is my shot of discussion on the possibilities of actuarial approach in the patent related field. Of course there are already many researches on each specific field related patent matter, so I can not

introduce them one by one in details but I will mention some of them which seem to be good to refer when we think about the relationship among existent approaches in the field and possible actuarial approaches.

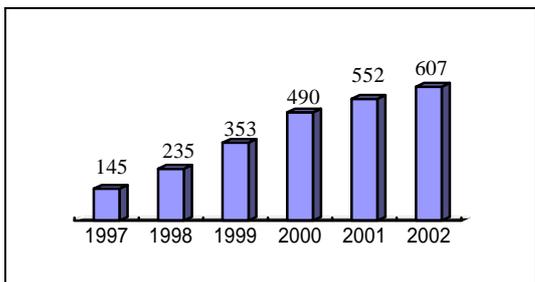
Recent Increase of Patent Valuation Needs in Japan

Progress of patent strengthening

Patent system of Japan has been frequently changed in these decades. Generally, it can be observed that many of the changes are related to the direction of strengthening patent rights. One of the big change was being introduced patent-for-substance in 1975; as a result, inventions for new substances became able to be protected stably. Before that, substances were protected only by process of making patents, so there were risks that a new substance could be provided into the market with avoiding patent protection if another process for making the substance was invented. From the latter half of 1970's to the latter half of 1990's, the range of inventions for patents had been expanding. For example, microorganisms, animals, and media for software are some of the expanded inventions which newly became in the patent range.

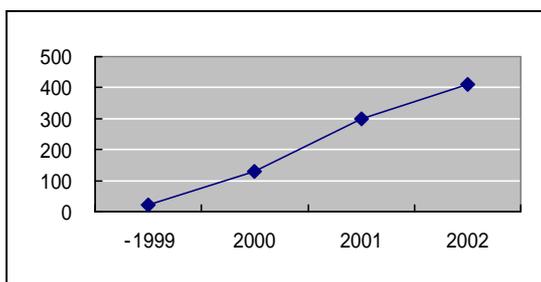
There were a lot of changes especially in 1998 and 1999. One of these is that: the necessary conditions for applying "Doctrine of Equivalent" was shown by Supreme Court. It allows a claim of a patent is construed in extended scope derived from the claim wording literally, to the limit that the protection range can be recognized as equivalent to the original patent claim. While there should be other conditions to apply the doctrine to the patent protection, it had been obscure until Supreme Court showed the conditions. Another one is that: regulations concerning presumption of damage amount in lawsuits against violation of patents, were introduced. By the regulations, patent holder's power in court was strengthened. Another one is that: regulations concerning Technology Licensing Organizations (TLOs) were maintained to expand technology transfer from universities to the industrial world. Here are graphs which show the increasing trend of the number of patent applications by universities and the increase trend of royalty income of TLOs. Looking at these figures, patent valuation needs has risen in technology transfer activities.

Graph 1- Number of patent application by Universities



Annual report 2003 - Japan Patent Office

Graph 2- Royalty income for TLOs (in million Yen)

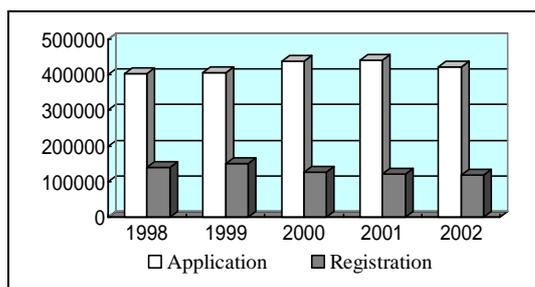


Annual report 2003 - Japan Patent Office

Internationalization

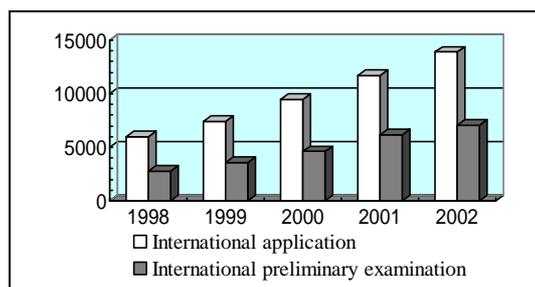
Both the number of patent applications and number of patent registrations in Japan are stable for these years as shown in graph 3. As space is limited, I do not show any international comparison, but the level of number in graph 3 can be said that it is already large number. Though the number of international patent application by Japanese companies was small compared to the advanced countries in patent such as the United States and European countries, it has been increased rapidly. Graph 4 shows the number of international application and number of international preliminary examination though Japan Patent Office, under the Patent Cooperation Treaty. International activity for getting patent rights will cost higher compared to the domestic ones. Therefore, it is reasonable to think that patent-driven companies have become severer in cost-performance of patent getting activities, and they are going to pay more attention about patent value assessment.

Graph 3- Number of patent application and registration



Annual report 2003 - Japan Patent Office

Graph 4- Number of international application



Annual report 2003 - Japan Patent Office

Recent development by the government

Since 2002, Government of Japan has taking some actions to enhance intellectual property (Table 1).

Table 1- Actions of Government of Japan related to Intellectual Property

Date	Activity	Contents
February 2002	Prime minister's address	Make Japan a nation built on intellectual property
July 2002	Announce Intellectual Property Policy Outline	Promote the strategic responses in the four field of creation, protection and exploitation in each aspect of the intellectual creation cycle, and the enhancement of the human foundation that supports these aspects
November 2002	Enact Basic Law on Intellectual Property	Establish the Intellectual Property Policy Headquarters
July 2003	Announce Strategic Program for the Creation, Protection, and exploitation of Intellectual Property	About 270 items to be done in the five field of creation, protection, intellectual property exploitation, the dynamic expansion of content business and developing human resources and improving public awareness

Strategic Program for the Creation, Protection, and Exploitation of Intellectual Property from 2003 consists of about 270 of specific target, contains a lot of items related to patent and technology promotion. For example:

- ✓ Assigning personnel in charge of intellectual property at R&D sites at Universities and Public Research Institutes
- ✓ Establishing Comprehensive Systems for Intellectual Property such as University Intellectual Property Headquarters and Technology Licensing Organizations (TLOs)
- ✓ Promoting University Start-ups
- ✓ Abolishing or Amending the Provision Regarding Employee's Inventions under the Patent Law
- ✓ Enforcing the Japanese Bayh-Dole System
- ✓ Expeditious examination of patent applications
- ✓ Researching the desirable way of providing patent protection of medical treatment
- ✓ Aiming to establish an Intellectual Property High Court
- ✓ Promoting efforts to establish a global patent system
- ✓ Promoting Disclosure of Information on Intellectual Property
- ✓ Establishing a Method of Intellectual Property Evaluation
- ✓ Utilizing Trust Systems to Promote Management and Mobility of Intellectual Property
- ✓ Supporting Patent Pools Contributing to Technical Standards
- ✓ Reinforcing the Stability of Intellectual Property License Contracts

- ✓ Promoting the Transnational Use of Intellectual Property through Tax Treaties
- ✓ Promoting the establishment of graduate courses, undergraduate courses and subjects on intellectual property and making intellectual property education attractive

One of the problems in the current environment of patent system in Japan is that: it takes long time for patent examination because there is an unbalance between the number of patent applications and the examination capability of Patent Office. Table 2 shows the average first-action-period, which indicates the waiting time from a request for examination to the first returning action from Patent Office. Japan patent office said that they will shorten the first action period dramatically; and it is included in the 270 goals.

Table 2- First action period

Fiscal Year	2000	2001	2002
First action period	21 months	22 months	24 months

Annual report 2003 - Japan Patent Office

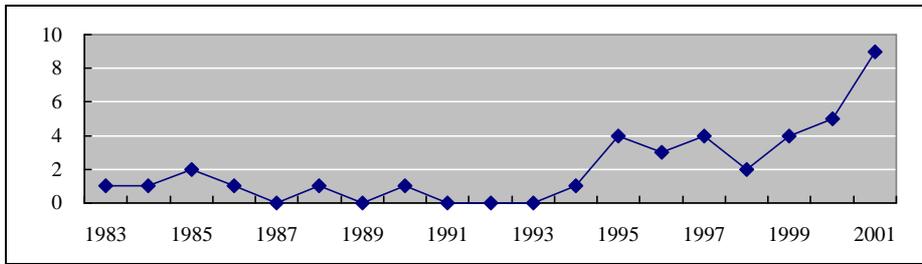
Other recent topics

The first patent backed securitization in Japan was set in 2003. According to the News Release by Japan Digital Contents Inc, the company who arranged the securitization, when Pin Change Co. Ltd, a subsidiary of Matsushita Electric Industrial, was going to get a exclusive license on the patents which were originally held by Scalar Corporation, a technology venture company, they used patent backed securitization scheme. The scheme contains setting up a TMK, Tokutei Mokuteki Kaisya in Japanese, which is a kind of company to be founded according to the SPC law. By the scheme, they could finance over 200 million yen from a bank and a trading company. The valuation of the patents was done by a lawyer with referring the investigations by two independent companies who had expertise in patent valuation.

Government of Japan has a plan that the Trust Business Law is going to be changed. The change will contain some relaxations for some limitations: the limitation of asset categories to be trusted, and the limitation of the eligibility for companies to getting into trust business. It will be great help for expanding patent backed finance, and it means that there is a big potential of demand of patent valuation. Moreover, if once patent backed securities are trading in the market, it is forecast that there will be a big increase of analyses needs for portfolio based performance and for risks, on the patent backed securities and their derivatives. So the possible new area will be not only valuation matter for individual patent.

Graph 5 shows the number of requests to Japan Patent Attorneys Association by Courts, to recommend a person as a patent valuator or a patent appraiser. The figure includes both of for patents and utility models. According to this figures, needs of the patent related valuation has risen also in the courts for these years.

Graph 5- Number of requests of recommendation a person as a valuator or an appraiser by courts

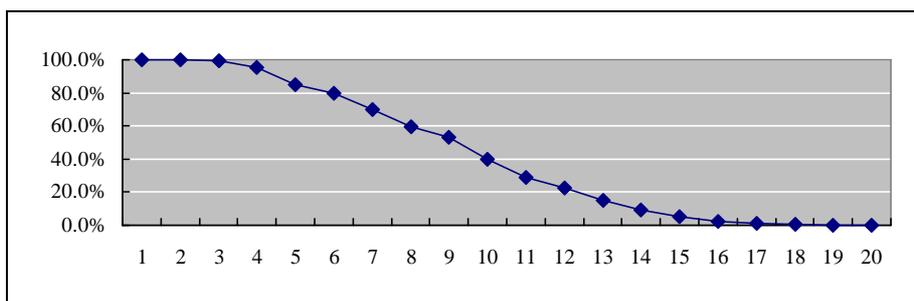


Investigation report of needs of intellectual property valuation- Japan Patent Attorneys Association (2002)

Considerations related patent valuation

When patent valuation is going to be done, it is necessary to be considered about peculiar risks to patents. In general, there are risks such that: the patent rights may be invalid, the technology using by the patent may be difficult to go into a further development stage caused by blocking by other patents, and alternative technology may be developed by others then the value of the patent rights will collapsed. They often comes to light in years later. The graph bellow is the survival ratio of registered patents. It showed us that 50% of patents die before their 10th anniversary.

Graph 6- Survival ratio of registered patents



Annual report 2003 - Japan Patent Office

There are other risks related to patent securitization because many parties are associated to the securitization with various contracts. An example of possible risks are: a technology related to the securitized patents may collide with other patents which are held by other company(companies), and the patent may be involved in some infringement lawsuits, and the licensee may become bankrupt.

Another big risks to patent driven companies are that: a patent holding company may be claimed by their employing (or having employed) inventors to pay reasonable one's share of the revenue from the invention, in later phase of business. There have been some big lawsuits for these years concerning this issue. The government's action plans contain a plan of changing regulation to decrease such a risk. The main contents of the regulation will say that the companies should set their own rule to reward to inventors, in advance with fair discussion. But now, it is difficult to say that it is clear whether patent holders can avoid such risks effectively by the possible new regulation because there still is a wording to keep the right for inventors to get reasonable reward.

Potential of Actuarial Approach for Patent Matters

Economic life table of patents

Here, I will use the term "economic life table of patents" in the meaning of a time series function of values of a patent or a group of patents. There is a limit of total period for a patent right renewal in each country. Yet the periods are different by countries, generally they are around 15-20 years. Therefore it is possible to think that the economic life of a patent is a decreasing function in the broad view which is going to zero at the end of the valid period. It is reasonable to presume that the character of the functions differ by certain categories of patents because market conditions and technology environments are different by the categories. For the categorization, actuaries can contribute by providing some statistical methods which are sophisticated in the area of financial applications. Of course estimating the curve of functions, in each of parametric and nonparametric approach, is the area which actuaries can be active, because the area is related to financial risks in the long time scale.

Considering for a particular patent (or a particular group of patents), the function may contain some increase phases locally because of some reasons: cash inflow may very small or zero in the early stage of the patent life, risks are not unreleased sufficiently in the early stage, and the capital market requires a certain interest rate although if it is a risk free asset. If we can consider a patent portfolio which include sufficient number and variety of patents, the economic life table of the portfolio may show a monotonic decrease function.

I believe that developing and studying these functions as analytical tools will not only be help for economical study on the patent system of a certain country, but it will be help for management for companies who is going to have investment portfolio including patent backed assets. For reference, Smith and Parr(2000) indicate that there is a very informative research on economic life functions of industrial properties called "Iowa Curves", which is first appeared in Iowa(1935). Iowa Curves

mainly indicate statistical retirement period for industrial properties, and they developed 18 types of curves to match the various industrial properties. Smith and Parr(2000) carefully discusses the methodologies for Iowa Curves, and show us thoughtful point when we use the ideas of Iowa methodology to develop economic life functions for intangible assets. Smith and Parr(2000) also contains an appendix related with this topic written by Dr. Charles E. Jerominski, which gives us a caution with further discussions that we have to be very careful to use Iowa curve when we face an appraisal depreciation practices for certain assets.

Valuation model

As we have observed before, needs of patent valuation is strong and it is getting more important in a lot of aspects. In actual scenes of the valuation, it is often judged from the combination of some results by different valuation models. There are many books and researches that provide us practical technique for this kind of purpose. Smith and Parr(2000) introduces many valuation models for intellectual property including the patent. Pitkethly(2002) discussed on using option method deeply, moreover it is informative for us to be able to find in the research many concrete explanation of the characteristic of cash flows and risks in the lifetime of the patent and early stage technology based development as well.

By Smith and Parr(2000), the valuation technique can be classified into the following three:

- ✓ Cost Approach
- ✓ Income Approach
- ✓ Market Approach

In these three, Income Approach can be thought that actuarial techniques will serve for it. Considering the character of cash flows and risks by patent related activities, it is a good object to apply the familiar techniques for dealing with financial risks or insurance risks. Here, let us give some example of issues that can be contributed by actuaries, in the scene of applying the Income Approach accounting uncertainty.

- ✓ Estimating of parameter for functions describing cash flow stream
- ✓ Setting risk factors to each cash flow
- ✓ Evaluation of credibility for outputs from specific calculation model
- ✓ Sensitivity test

Application of results from recent studies on financial risks

There are some potential areas relating patent matters that actuaries can apply the results from recent studies on financial risks.

✓ Risk management with assuming distribution functions other than normal distribution:

Yet a patent valuation has been done with the best effort, it often occurs that the real performance is experiencing far from the expected one at the valuation. Financial performance of patents have such a character: relatively small number of patents show their very high economic performance while large number of patents show their poor performance or short economic lives. It causes distribution functions being skewed. To dealing with investment portfolios including patent backed assets, we should consider the skewness of the financial performance of the portfolios. In addition, it may also be needed to think about strong correlation among some kind of patents. To discuss about the character such that risks, recent development on various application of using EVT and Copula can be one of the help.

✓ Incomplete market:

As financial technology is developed continuously, we will be able to deal with various kinds of patent related financial products. Because of the original characters of each individual asset, we have to regard that the products are in the incomplete market. As well as insurance backed assets and real estate backed assets, patent backed assets are interesting object to apply the financial theory for the incomplete market.

✓ Real option:

Real option approach is often given as one of the effective techniques for patent valuation. There are many decision points for a company who has a particular technology supported some inventions or patent rights, in the life of the technology. In the early stage of the technology, these will be to decide: that whether or not the company should file patent applications for the technology; to what country should the patent be applied; whether or not the company should register the patents – it usually takes several years from the application to the time that the patent can be registered. In the later stage, when the technology has been thrown into the market as a service or a product, whether or not the company should renew the patent rights will be also to decide, because the patent renewal fee will not be cheap while the technology may become cheap in the future market. Recently, option pricing theory for the incomplete market is being further developed, and we know that a lot of actuaries are able to discuss about its application to some asset categories which contains real options. For the further development on the patent valuation, it will be valuable that the actuaries offer theoretical frameworks of some method to check the appropriateness for some particular valuation techniques which include some real option approaches.

Insurance

There have already been some kind of insurance covers related to patent matters. There is also further potential to develop some kind of insurance covers related to patent matters. For example, patent

litigation cover for patent rights user and holder, and patent invalid cover for licensee and licensor. In the scenes of insurance product development, pricing, underwriting, liability valuation and risk transfer, actuaries who have sufficient knowledge of patent can be active.

Conclusion

The circumstance for intellectual property matters in Japan has been dramatically changing. There are many companies and people who are getting into business related to this area. We have had a brief observation on patent matters in Japan and discussed the potentials of application including management risks of patent cash flows. I hope some of actuaries will go into these areas and produce specific researches or develop practical techniques in this field. I think the other fields of intellectual property are also attractive areas to study for actuaries.

References

- [1] Intellectual Property Policy Headquarters (Japan) (September 19, 2003): *Strategic Program for the Creation, Protection and exploitation of Intellectual Property*
- [2] Iowa Engineering Experiment Station of Iowa State University (1935): *Statistical analysis of Industrial Property Retirements* : Bulletin 125, Iowa State University
- [3] Japan Digital Contents Inc. (2003): *Japan Digital Contents(JDC) arranged the first securitization of a patent rights* : news release on April 2, 2003 (in Japanese language)
- [4] Japan Patent Attorneys Association (2002): *Investigation report of needs of intellectual property valuation* (in Japanese language)
- [5] Japan Patent Office (2003): *Annual report 2003* (in Japanese language)
- [6] Pitkethly, Robert (2002): *The valuation of patents: A review of patent valuation methods with consideration of option based methods and the potential for further research* : Background paper for discussion for High Level Task Force on Valuation and Capitalization on Intellectual Assets, United Nations
- [7] Smith, Gordon V. and Parr, Russell L. (2002): *Valuation of Intellectual Property and Intangible Assets, Third Edition* : John Wiley & Sons, Inc.
- [8] Strategic Council on Intellectual Property (Japan) (July 3, 2002): *Intellectual Property Policy Outline*