

WIPO - UNU Joint Research Project

Impact of the Intellectual Property System on Economic Growth

Fact-Finding Surveys and Analysis in the Asian Region

General Remarks

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1. Introduction

1.1 WIPO Research and WIPO Japan Office

Establishment of the WIPO Japan Office was proposed by the Commissioner of the Japan Patent Office at the General Assembly of WIPO in 2005. The WIPO Japan Office was established in Tokyo in September of 2006 and is expected to play an important role for the academic research on issues of intellectual property and development.

WIPO Research in the WIPO Japan Office is proceeding as joint research between the WIPO Japan Office and United Nations University (UNU), which is sponsored by the Japan Funds in trust.

1.2 Outline of Research

1.2.1 Objective of this Research

The objective of this research was to measure the “Impact of the Intellectual Property System on Economic Growth.” This research is targeting Asian countries, out of which Japan, Korea, China, Vietnam, Malaysia and India were chosen because these countries have experience strengthening their IP systems and thereby enhancing their economic growth.

1.2.2 Schedule of this Research

- | | |
|------------|--|
| Jan., 2007 | Start of this Research
(Research Team and Methodology were approved by WIPO.) |
| Feb., 2007 | 1 st Symposium and Meeting in Japan
(All the National Experts attended and engaged in discussion at the National Graduate Institute for Policy Studies.) |
| May, 2007 | 2 nd Symposium and Meeting in Japan
(All the National Experts attended and engaged in discussion at the United Nations University.) |
| June, 2007 | Submission of the Interim Report to WIPO |

Sep., 2007 Submission of the Final Report to WIPO

(Note) The Steering Committee, which is comprised of the WIPO Japan Office, United Nations University, the Japan Patent Office, and the Chief Expert, was established. The general matters related to this research such as the research schedule, the research methodology, the Symposium, and the contents of final report were discussed in Steering Committee.

1.2.3 Research Team

The Research Team was comprised of the Chief Expert, National Experts (from Japan, Korea, China, Vietnam, Malaysia and India) and Advisors.

This Research Team was established through the discussion in the Steering Committee and finally approved by WIPO.

(Note) Each National Expert was in charge of the research in his/her own country and the corresponding report and presentation. The Chief Expert was in charge of all of the research by the National Experts and all the reports (the interim report and the final report) about this research. Advisors are in charge of providing some advice about this research if necessary.

2. Methodology

2.1 Background

- 1) Proponents maintain that the intellectual property system (IP system) is an effective way to enhance creativity, promote technological innovations, improve trade and enhance competitive positioning. However, how effective the IP system is as a means to achieve economic development is still to be confirmed. Some developing nations raised this question --- the IP system may not necessarily be the most effective and appropriate way to fuel the economy.
- 2) There is a strong demand for empirical data, verification, and detailed information on possible impacts that the IP system might have on economic development, which will enable the aforementioned question to be answered.
- 3) A Chief Expert from Japan, assisted by a number of other eminent IP and economic experts from China, India, Korea, Malaysia and Viet Nam, will coordinate the research project between Japan, UNU and WIPO. Each expert will work on the preparation of a report based on an empirical study of his/her country's IP systems or IP policy and respective situation and experience. It is expected that the research projects will focus on areas particularly relevant to the economic impact of IP on developing countries, analyze the relationships between IP and technology transfer, and focus on the area of the protection of genetic resources and traditional knowledge.

2.2 Research Methodology

This research included three kinds of research methodology as follows in 2.2.1 – 2.2.3.

2.2.1 Survey on Reforms towards IP-based Economic Development

- 1) Many developing countries have been working to improve their IP systems through various measures including the implementation of the TRIPS Agreement and revisions to their national laws/regulations in line with the efforts made by WIPO and other international organizations towards international systems harmonization. In this survey, major reforms that are expected to have an important influence on economic development were

identified.

2) Specifically, economic changes were analyzed comparing the situations before and after IP system reforms (see a) through e) below) and the significance of these changes was assessed.

a) Trends in the numbers of application filings/registrations
(Percentage changes in the numbers of application filings/registrations, the shares of filings by major applicants, etc.).

b) Changes in corporate activities -
(R&D, sales, IP-related budgets, IP-related lawsuits, etc.).

c) Trends in license agreements
(License fees, trends in the number of licensing agreements, technical balance of trade, etc.).

d) Trends in domestic economies
(GDP, numbers of employed persons, unemployment rates, etc.).

e) Trends in investments by foreign capital corporations
(GDP, amounts of domestic investments, numbers of domestic investments, nationalities of foreign capital companies, etc.).

(Note) The economic effects resulting from the use of an IP system were analyzed from the perspectives of the national economy and by the fields of technology.

2.2.2 Case Studies on Companies utilizing the IP System to develop Business or increase Economic Activity

1) For the IP-related reforms defined as having a major impact on economic development at the country level, company-level case studies were conducted by the field of business activity. Based on specific case studies, economic effects brought about by the IP system were examined.

2) To gather information about each case, the corporations participating in the survey were interviewed and a questionnaire was sent to them. In this survey, changes in corporate activities were analyzed comparing the situations

before and after IP system reforms (see f) through h) below), and the significance of these changes was assessed.

- a) Trends in the numbers of application filings/registrations
(Percentage changes in the numbers of application filings/registrations, etc.).
- b) Changes in corporate activities
(R&D, sales, IP-related budgets, IP-related lawsuits, etc.).
- c) Trends in license agreements
(License fees, trends in the number of licensing agreements, technical balance of trade, etc.).

(Note) 3-4 target corporations were chosen from among the top 10 applicant companies in each country. The economic effects resulting from the use of IP system were analyzed from the perspectives of the national economy and by the fields of technology.

2.2.3 Analysis of Reforms that exerted Influence on Economic Development underpinned by the IP System using Economic Models

Impact on IP creation

- 1) For the IP-related reforms defined as having a major impact on economic development in the above Item 1, an experimental analysis was conducted of each field of technology using an economic model. Based on the results of the analyses, IP creating effects were examined.
- 2) While paying attention to the changes in the situations before and after IP-related reforms, using such economic indexes as R&D, GDP, and IP index of each technological field as explaining variables, the effects that such reforms had on IP creating effects (explained variable) was analyzed.

- i) Impact on intellectual property creation

$$\ln(\text{Number of obtained patents}) = \gamma_1 * \ln A + \gamma_2 * \ln B + \gamma_3 * \ln (\text{IP index by the field of technology}) + \varepsilon$$

(Note) A: R&D, B: GDP

-- Not only for the number of patent obtainments but also for other factors such as licensing revenue, a similar analysis was conducted.

--- The current IP policies could be quantitatively and accurately assessed by centering on certain technological fields.

The economic effects resulting from the use of IP system were analyzed from the perspectives of national economy and by field of technology.

Impact on economic effects of business activities

- 1) For the IP-related reforms defined as having a major impact on economic development at the national level, an experimental analysis was conducted using an economic model. Then, based on the experimental analysis, economic effects were examined.
- 2) While paying attention to the changes in the situations before and after IP-related reforms, using such economic indexes as private capital, labor force, and IP index as explaining variables, the effects such reforms had on domestic production (explained variable) were analyzed.

i) Impact on economic effects of business activities

$\ln(\text{domestic production}) = \beta_1 * \ln K + \beta_2 * \ln L + \beta_3 * \ln(\text{IP index of the country}) + \varepsilon$

(Note) K: Private capital, L: Labor force

-- Not only for domestic production but also for IP production, number of obtained IP rights, and licensing revenue, a similar analysis was conducted.

-- Based on the above formula, the result was that, by raising the IP index of the country by x, domestic production could be increased by y.

--- The current IP policies could be quantitatively and accurately assessed.

(Note) The economic effects resulting from the use of the IP system were analyzed from the perspectives of the national economy.

Impact on foreign direct investments (FDI)

- 1) For the IP-related reforms defined as having a major impact on economic development at the national level, an experimental analysis was made using a direct investment model. Then, based on the results of the analyses, the effects such reforms had on foreign direct investment were examined.
- 2) While paying attention to the changes in the situations before and after IP-related reforms, using such economic indexes as GDP, population, and IP index as explaining variables, the effects such reforms had on creating effects (explained variable) were analyzed.

i) Impact on FDI

$$\ln (FDI) = \delta_1 * \ln P + \delta_2 * \ln Q + \gamma_3 * \ln (IP \text{ index }) + \varepsilon$$

(Note) A: GDP, B: population

(Note) The economic effects resulting from the use of the IP system were analyzed from the perspectives of the national economy.

General Points and Assumptions

- 1) Such variables as the number of patent obtainments, foreign direct investment, GDP, and population used for (1) Impact on intellectual property creation, (2) Impact on business activities, and (3) Impact on foreign direct investments changed at a constant rate over the year of survey. In conducting the analyses, such changes were taken into account.
- 2) The surveys conducted under the above items covered such industries as pharmaceuticals, automobiles, information technology and manufacturing.

3. Results of Research

3.1 Survey on Reforms towards IP-based Economic Development

(General Remarks)

- The trend in the filing of patent applications is very similar to other trends involving some economic data such as GDP, R&D expenditures and Foreign Direct Investment in many countries. (Japan, Korea, China, Vietnam, Malaysia, India) These data suggest that the IP creation is closely related to economic effects.

- After the reform of the IP system, some economic data such as GDP, R&D expenditures and Foreign Direct Investment greatly increased in many countries. (Japan, Korea, China, Vietnam, Malaysia, India) These data suggest that the IP system is closely related to economic effects.

- After the enjoyment of IP-related treaties such as TRIPS, some economic data such as GDP, R&D expenditures and Foreign Direct Investment greatly increased in many countries. (Korea, China, Vietnam, Malaysia, India) These data suggest that the IP-related treaty is closely related to economic effects.

- In the fields of chemistry, pharmaceuticals and biotechnology, the introduction of the patent systems for substances has had some effects on the number of patent applications or some economic data such as technology trade and R&D expenditures in some countries. (Japan, Korea, India)

- In the case of universities, the introduction of the IP system or IP policy for universities has had some effects on the number of patent applications or some economic data such as the technology transfer in some countries. (Japan, Malaysia)

(Japan)

- After the introduction of the patent system for substances in 1975, R&D expenditures and technology trade as well as the number of granted patents began to increase much more than before in the pharmaceutical industry. (Fig.3, Fig.4 and Fig.5 in Japanese National Report) These data suggest that the IP system is closely related to IP creation and economic effects in the pharmaceutical field.

- After the introduction of the Act Promoting Technology Transfer from Universities to Industry in 1998, the benefits gained by universities from patent licensing as well as the number of patent applications filed by universities began to increase much more than before. (Fig.6 and Fig.7 in Japanese National Report) These data suggest that the IP system is closely related to IP creation and economic effects in the fields of technology transfer.
- IP policy has been rapidly advanced since 2002 in Japan. The Basic Law on Intellectual Property, enacted in 2002, has had a significant impact on Japanese industry because it was the basis for the Intellectual Property Strategy Headquarters, established in 2003, and is the basis for the Intellectual Property Strategic Program, annually revised since 2003. The competitiveness ranking of Japan among the nations of the world greatly increased after the year 2002, which reflects the impact of the Basic Law on Intellectual Property on the Japanese economy. (Fig. 8 in Japanese National Report)

(Korea)

- After the introduction of the patent system for substances in 1986, the number of the patent applications greatly increased much more than before. It increased from 12,759 in 1986 to 17,062 in 1987. Afterwards, it rose by approximately 2,000 to 3,000 every year until 1993. (Graph 1 in Korean National Report) These data suggest the correlation between the IP system and IP creation in the pharmaceutical field.
- After the enjoinderment of TRIPS in 1995, the number of patent applications increased much more than before. It increased from 45,712 in 1994 to 90,326 in 1996. (Graph 1 in Korean National Report) Also, the number of domestic patent applications in Korea has increased much more than the number of patent applications from foreign countries since 1995. (Graph 2 in Korean National Report) These data suggest that TRIPS has an effect on domestic IP creation.
- Foreign Direct Investment greatly increased from US\$ 1,316,505 in 1994 to US\$ 15,544,618 in 1999. (Graph 5 in Korean National Report) This suggests that TRIPS has an effect on FDI as well as IP creation.
- The trends of R&D expenditures and GDP have been very similar to those of

patent applications since 1980, which suggests that R&D and GDP are closely related to IP creation. (Graph 1, Graph 3 and Graph 6 in Korean National Report)

(China)

- After the enjoinderment of the TRIPS in 2001, the IP Index went up, and the number of patent applications greatly increased, which is expected to have been caused by TRIPS. (Figure 2 and Figure 3 in Chinese National Report) The number and the trend of domestic patent applications are almost the same as those of the patent applications from foreign countries. This suggests that TRIPS is also effective on domestic IP creation in China.
- GDP and R&D expenditures have greatly increased since 2001, which is considered to be caused by TRIPS. (Figure 1 and Figure 7 in Chinese National Report)
- The trend of patent applications has been very similar to that of GDP and R&D expenditures since 1990, which suggests that GDP and R&D expenditures are closely related to IP creation. (Figure 1, Figure 3 and Figure 7 in Chinese National Report)

(Vietnam)

- After the introduction of IP-related provisions in the Civil Law in 1995, the number of the patent applications increased much more than before. (Fig.4 and Table 1 in Vietnamese National Report) In 1995, the gross output of Industry increased much more than before. (Fig.3 in Vietnam National Report) These data suggest that the IP system is closely related to IP creation and economic growth in Vietnam.
- After the introduction of the Intellectual Property Law in 2006 and the enjoinderment of TRIPS in 2006, the number of patent applications greatly increased. The number of patent applications greatly increased from 2005 to 2006, and FDI also greatly increased from 2005 to 2006. These data suggest that new IP law and TRIPS have had effects on IP creation and FDI.
- The trends of GDP and Gross output of Industry have been very similar to those of patent applications since 1995. (Fig.1 and Fig.3 in Vietnam National Report) This suggests that GDP and the Gross output of Industry are closely related to IP protection.

(Malaysia)

- Since the implementation of a domestic patent registration system in 1986, the number of patent applications has been steadily increasing. (Fig.5 in Malaysian National Report) This suggests that the IP system is closely related to IP creation in Malaysia.
- After the introduction of a modified substantive examination in 1993, the number of patent applications dramatically increased. (Fig.5 in Malaysian National report) This suggests that IP practice is closely related to IP creation in Malaysia.
- After the enjoyment of the Paris Convention in 1990, the number of patent applications and GDP greatly increased. (Fig.10 in Malaysian National Report) This suggests that the Paris Convention has had an impact on IP creation and economic growth in Malaysia.
- After the enjoyment of TRIPS in 1995, the number of patent applications and R&D expenditures greatly increased. (Fig.3 and Fig 10 in Malaysia National Report) This suggests that TRIPS has had an effect on IP creation and R&D in Malaysia.
- The patent law was revised in 2000 in compliance with TRIPS. Thereafter, royalties drastically increased from 2002 to 2005, which is considered to have been caused by TRIPS. (Figure 4 in Malaysia National Report)
- Since the implementation of the National Science and Technology Policy in 1995, the number of patent applications from local universities and research institutions has shown a huge increase. (Fig.9 in Malaysian National Report) This suggests that Science and Technology Policy is closely related to the IP creation of universities in Malaysia.
- The trend of GDP is very similar to that of the number of patent applications since 1980. The number of the patent applications decreased during the years of the economic recessions in 1986-1987 and in 1997-2000. (Fig.10 in Malaysian National Report) This suggests that the IP system is closely related to economic growth in Malaysia.

(India)

- After the enjoyment of TRIPS in 1995, Indian patent law was revised three times in compliance with the provisions of TRIPS. The first revision of patent law in compliance with TRIPS was in 1999, which introduced Exclusive Marketing Rights for the patent holders of drugs or medicines. The number of patent applications has greatly increased in India since 1999. The number of patent applications was 4,924 in 1999 - 2000, and 8,503 in 2000-2001. (Fig.1 in Indian National Report)
- The second revision of Indian patent law in compliance with TRIPS was in 2002, which extended the term of a patent right. R&D expenditures and GDP have increased much more than before since 2003, which reflects the impact of the IP system on the economy. (Fig.1 and Fig.4 in Indian National Report) The number of granted patents greatly increased since 2003 in India, and the number of Indian domestic patents granted moved ahead of the number of patents granted to applications from foreign countries for the first time in 2004 - 2005. It suggests that TRIPS is also effective in domestic IP creation in India. (Fig.5 in Indian National Report)
- The third revision of Indian patent law in compliance with TRIPS was in 2005, which introduced the patent system for substances. The number of patent applications has greatly increased in India since 2005. (Fig.2 in Indian National Report) This suggests that the introduction of the patent system for substances has had an effect on IP creation.
- The trend of patent applications has been very similar to that of R&D expenditures since 1999, which suggests that R&D is closely related to IP protection. (Fig.4 in Indian National Report)

3.2 Case studies on companies utilizing the IP system to develop business or increase economic activity

(General Remarks)

- In the pharmaceutical field, the number of patent applications is greatly increasing after TRIPS in some countries. (Korea, China, Malaysia, India). Some major companies, such as Takeda in Japan and Ranbaxy in India, have been very successful in this field. Takeda have been very active for IP management, and Ranbaxy also applied some useful patents.
- In the information technology field, the number of patent applications is greatly increasing after TRIPS in some countries. (Korea, China, Malaysia, India) Some major companies, such as Sony in Japan and SAMSUNG in Korea, have been very active for IP management and have greatly grown.
- In the machinery field, the number of patent applications is greatly increasing after TRIPS in some countries. (Korea, China, Malaysia) Some major companies, such as Canon in Japan and Duy Loi in Vietnam, have been very successful in this field. Canon has traditionally placed a high priority on IP creation, and Duy Loi has been active for IP management.
- In the automobile field, the number of patent applications is greatly increasing after TRIPS in some countries. (Korea, China, Vietnam) Some major companies, such as Toyota in Japan and HYUNDAI in Korea, have been active for IP management and have greatly grown.

i) Pharmaceutical Industry

(Japan)

- As for the size of a company in Japan, major companies in the pharmaceutical field are not as large as those in the fields of manufacturing and automobiles. However, some companies have become larger through M&A. The number of patent applications in the biotechnology field has increased since around 1997, when the Examination Guideline for Biology-related Inventions was issued by the Japan Patent Office. This suggests that the IP practice enhances IP creation.
- Five major companies in the pharmaceutical field were a focus of this study. The royalties of these five companies has increased since around 1999.

Recently, Japanese intellectual property policy has placed a higher priority on the utilization of patents than on the application of patents. This trend in royalties in the pharmaceutical field seems to have been caused by the recent intellectual property policy in Japan. (Fig.10 in Japanese National Report)

- Takeda Pharmaceutical Company Limited is one of the IP-based companies in the pharmaceutical field in Japan. The technological level in the pharmaceutical field is changing rapidly because biotechnology plays an important role for the development of new medicines. Takeda is applying for patents in the field of biotechnology in order to develop biotechnology-related new medicines. Takeda has connected IP division and R&D division in order to plan the IP strategy effectively. Takeda has advanced the strategic patent applications and the utilization of IP, which provided a lot of royalty to Takeda. Intellectual property has been one of the most important factors for current Takeda's success.

(Korea)

- Since the introduction of the patent system for substances in 1986, the number of patent applications in the chemical field has constantly increased. Since the introduction of the Examination Guideline on Biotechnology of the Korean Intellectual Property Office in 1998, the number of the patent applications in the chemical field has drastically increased. These data suggest that the IP system enhances IP creation. (Graph 7 in Korean National Report)
- DONG-A and YUHAN corporations are representative companies in the pharmaceutical field in Korea. They have applied for patents constantly for several years, although the number of patent applications filed has not been many. These companies' filing activities were constant even during the IMF crisis. The R&D expenditures of these companies have gradually increased for several years, even during the IMF crisis. These data suggest that the pharmaceutical companies such as DONG-A and YUHAN place a high priority on intellectual property and R&D in their management strategy. (Graph 9 and Graph 10 in Korean National Report)

(China)

- The number of patent applications and R&D expenditures has drastically increased in the pharmaceutical field in China since 2001 when China joined TRIPS. (Figure 5 in Chinese National Report) This is expected to be one of

the effects of TRIPS.

- The trends of patent applications and R&D expenditures have been similar in the pharmaceutical field, which suggests the existence of a close relationship between R&D and IP protection. (Figure 5 in Chinese National Report)
- The North China Pharmaceutical Group Corporation (NCPC) is a representative company in the pharmaceutical field in China. The number of Patent applications of NCPC is not as many as that of the companies in other major fields such as IT and automobiles. However, the number of patent applications has increased dramatically since 2001 when China joined TRIPS. R&D has also increased since 2001. (Figure 11 and Figure 12 in Chinese National Report) This suggests that TRIPS has had an impact on IP creation and R&D.

(Vietnam)

- R&D capacity is weak in the pharmaceutical field, and most technology is imported in Vietnam although there are about 170 companies for modern medicines and about 300 for traditional medicines in Vietnam. Therefore, IP activities are mainly concerned with trademarks and industrial designs, but not patents in Vietnam.
- Traphaco is a representative company in the pharmaceutical field in Vietnam and produces about 170 products, including 60 traditional medicines and 110 modern medicines. Their traditional medicines are their best-known products in Vietnam. Traphaco has applied for intellectual property since the late 1990's, and the company had a total of 113 intellectual properties in 2006. (Table 2 in Vietnam National Report) One of the reasons for Traphaco's success must be its intellectual property rights.

(Malaysia)

- The highest number of patents granted among major fields is in the pharmaceutical sector. The rate of growth has been phenomenal, from a mere 10 patents in 1989 to 321 in 2006. (Fig.8 in Malaysian National Report) The domestic investment in this field increased from 1996 to 2005. It is considered to be the effect of the introduction of 'purpose bound product claim' in 1993.
- Hovid Berhad is a representative company in the pharmaceutical field in

Malaysia. Hovid Berhad is active in the development and manufacturing of pharmaceutical specialties. Hovid Berhad has applied for patents not only in Malaysia but also in other countries, although the number of patent applications has not been many. In 2006, applications for two different inventions were filed, one of which was filed in 19 foreign countries and the other in 11 foreign countries. The IP strategy of Hovid Berhad has been very international. (Table 4 in Malaysian National Report) Intellectual property has been one of the most important factors for the current success of Hovid Berhad.

(India)

- The pharmaceutical industry today is in the top-ranking science-based industry in India with wide ranging capabilities in the complex field of drug manufacturing and technology. The patent system is expected to be very important for the pharmaceutical industry in India.
- Ranbaxy and Dr. Reddy's Laboratories are representative companies in the pharmaceutical field in India. These two companies have applied for many patents; i.e., 259 patent applications by Ranbaxy and 205 patent applications by Dr. Reddy's Laboratories between 1995 and 2005. (Table.1 in Indian National Report) Intellectual property has been one of the most important factors for the current success of Ranbaxy and Dr. Reddy's Laboratories.
- Ranbaxy and Dr. Reddy's Laboratories have had much R&D expenditures and much revenue as well as many patent applications since 1995. This suggests TRIPS has had an effect on economic growth as well as on the IP creation of these companies. (Table.1 in Indian National Report)

ii) Information Technology Industry

(Japan)

- Five major companies in the information technology and manufacturing were a focus of this study. The royalties of some major companies in the information technology have increased since around 1999. Recently, Japanese intellectual property policy has placed higher priority on the utilization of patents than on the applications of patents. This trend of royalties seems to have been affected by recent intellectual property policy in Japan. (Fig.11 in Japanese National Report)

- Sony is one of the IP-based companies in the field of the information technology. The economic growth in this field has been very active because of the diffusion of digital technology. Sony is actively utilizing IP, and selecting IP strategy from self-utilization, license and cross-license in respective cases. Recently, Sony collaborated with SAMSUNG in the utilization of IP. Sony's IP strategy includes so called "patent portfolio", which has been applied to the Organic electroluminescence (EL) display in Sony. Sony's IP strategy also includes so called "patent pool" because many patents tend to be included in one product. Intellectual property has been one of the most important factors for current Sony's success.

(Korea)

- The information technology is one of the fastest developing fields in Korea. The number of patent applications in the information technology has been significantly increasing for the past several years. (Graph 8 in Korean National Report) R&D and Sales in information technology show similar trends to that of patent applications. (Graph 11 in Korean National Report) These data suggest that there is a relationship between IP creation and economic growth.
- SAMSUNG Electronics is a representative company in the information technology field in Korea. The number of patent applications of SAMSUNG Electronics has mainly increased since 1994, although it decreased from 1998 to 2000, which seems to have been the result of the IMF crisis. The R&D expenditures of SAMSUNG also decreased once and have increased again. (Graph 12 and Graph 13 in Korean National Report) These data suggest that there is a relationship between IP creation and R&D.
- The number of patent applications and R&D expenditures of SAMSUNG Electronics have been increasing these days, which suggests that a close relationship exists between patent applications and R&D. (Graph 12 and Graph 13 in Korean National Report) These data suggest that intellectual property and R&D must be one of the important factors for the current success of SAMSUNG.

(China)

- The number of the patent applications and R&D expenditures have drastically increased in the information technology field in China since 2001 when China joined TRIPS. (Figure 6 in Chinese National Report) This is

expected to be the effect of TRIPS.

- The trends of patent applications and R&D expenditures are similar in the information technology field in China, which suggests a high correlation between R&D and IP protection.
- Huawei Technologies is a representative company in the information technology field in China. The number of patent applications of Huawei has increased since 2001 when China joined TRIPS. (Figure 3 in Chinese National Report) Huawei's revenue has greatly increased since 2001 although its net income is increasing slowly. (Figure 4 in Chinese National Report)

(Malaysia)

- A sudden growth of patent grants in the IT industry is seen in 2006. From a mere 2 patents in 1990, this has grown by 500% to 101 patents in 2006. The increase is apparent from 1998 onwards. (Fig.8 in Malaysian National Report) This phenomenon could be attributed to all the special measures adopted by the Government to boost the development of the IT industry in Malaysia, particularly the establishment of the Multimedia Super Corridor and the increase in funding of R&D on IT-related projects.
- FTEC is a representative company in relation to the computers and peripherals and the ICT software sub-sector in the Information Technology field in Malaysia. As it is an assembler, trademarks are more important than patents. (Table 1 in Malaysian National Report) TELEKOMS MALAYSIA Berhad and MOTOROLA MALAYSIA are representative companies in the telecommunications sub sector of the Information Technology field in Malaysia. These companies have already obtained some patents. In terms of numbers of IP applications, TELEKOMS surpasses other local companies, not only in the area of patents, but also in trademarks and industrial designs (Table 2 in Malaysia National Report). These companies have applied intellectual properties and become successful.

(India)

- The information technology industry in India has been recognized globally, and it is in a leading, Indian science-based industry. Industry as well as the Government is making every effort to retain this situation in a manner conducive to respecting the intellectual property rights of others and

exploiting one's own intellectual properties.

- WIPRO is a representative company in the field of information technology in India. WIPRO is active the areas of patent applications and R&D. WIPRO has had significant global sales and much revenue as well as many patent applications since 1995. This suggests that TRIPS has had an effect on the economic growth as well as IP creation of WIPRO. (Table.1 in Indian National Report)

iii) Manufacturing Industry

(Japan)

- Five major companies in the information technology and manufacturing are the focus of this study. The royalties of the companies in manufacturing have increased since around 1999. Intellectual Property Policy has changed to value to utilizing patents more than obtaining patents. This trend of royalties seems to have been an effect of recent intellectual property policy. (Fig.11 in Japanese National Report)
- Canon is one of the IP-based companies in the field of manufacturing of precision instruments. Canon is one of the companies which have applied many patents in this field. Canon has traditionally place a high priority on the intellectual property as its culture. Canon has encouraged researchers to apply patents as well as scientific reports. The section of the intellectual property has closely linked to that of R&D. Management for the intellectual property has been one of the most important factors for current Canon's success.

(Korea)

- The number of patent applications in the manufacturing field is increasing though the growth of patent applications is not as great as that in the IT field. (Graph 8 in Korean National Report)
- DOOSAN Infracore is a representative company in the manufacturing field. The number of patent applications of DOOSAN Infracore has increased since 1994 though it decreased from 1997 to 2000, which seems to have been the effect of the IMF crisis. The R&D expenditures of DOOSAN decreased once and have also increased again, which is similar to that of patent applications. These data suggest that there exists a relationship between IP creation and R&D.

(China)

- Xuzhou Construction Machinery Group (XCMG) is a representative company in the manufacturing field in China. They have applied for patents mainly since 2001, when China joined TRIPS. The number of patent applications is not as many as that in other fields such as IT and automobiles, which means that XCMG is not strong enough to innovate.

(Vietnam)

- There are two companies which are paying attention to IP issues in the manufacturing field. (Table 2 in Vietnam National Report) Duy Loi, whose major product is a hammock, is very successful in the domestic market. Duy Loi also exports to the United States, Japan, South Korea and Australia. It has a law consultancy for IP related issues though it is a small company. Duy Loi has applied for some intellectual properties and has won in two suits in the United States and Japan relating to industrial design infringements. Intellectual property has been one of the important factors for Duy Loi 's current success.
- Sannam , whose major products are metal working machines and equipment, is a very successful company in the field of manufacturing in Vietnam. Intellectual property has been one of the important factors for Duy Loi 's current success. It is paying attention to IP issues, and it has some law consultancies for IP related issues. Sannam has applied for many intellectual properties, and intellectual property has been one of the important factors for Sannam's current success.

(Malaysia)

- The machinery sector remains an important sector as can be seen by the number of patent grants. In the year 2006, a total of 61 patents were issued to the machinery sector which amounts to 0.9 % of the total number of patents granted. (Fig.8 in Malaysian National Report)
- Favelle Favco Berhad, involved in the manufacture of customised offshore lifting cranes and also construction tower cranes, and Cooper Cameron Sdn Berhad, involved in the manufacture of oil and gas pressure control equipment, are representative companies in the machinery field in Malaysia. Both companies do not own any patents in Malaysia, relying mainly on trade secrets law.

iv) Automobile Industry

(Japan)

- Five major companies in the automobile industry were a focus of this study. R&D expenditures in the automobile industry have increased since around 1999. This means that new technology has been created aggressively in this field. Companies have been aggressively applying for patents because of the aggressive creation and innovation in this industry. (Fig.12 in Japanese National Report)
- Toyota is one of the IP-based manufacturers in the automobile industry. The patent applications are of high quality, and this trend is very stable. Also, R&D expenditures are the same trend as the patent application. Toyota's IP strategy includes so called "the patent portfolio", which has been applied to many automobile because they are comprised of many intellectual properties. Toyota is advancing to select specific fields by the analysis of the patent application trends. Then, R&D is concentrated on these fields. Intellectual property has been one of the most important factors for current Toyota's success.

(Korea)

- HYUNDAI is a representative company in the automobile field. The number of the patent applications of HYUNDAI increased since 1995, which seems to be influenced by TRIPS. HYUNDAI seems to have been influenced by the IMF crisis because the number of the patent applications decreased around this crisis. (Graph 12 and Graph 13 in Korean National Report)
- The number of patent applications and R&D expenditures of HYUNDAI are increasing together these days, which suggests the close relationship between patent applications and R&D. (Graph 12 and Graph 13 in Korean National Report) These data suggest that the intellectual property and R&D must be one of the important factors for HYUNDAI's current success.

(China)

- China First Automobile Works Group Corporation (FAW) is a representative company in the automobile field in China. The number of patent applications of FAW has increased since 2001, when China joined TRIPS. Recently the benefit of FAW has not increased, the reason for which is thought that IP is obtained for defensive purposes and not aggressively utilized.

(Vietnam)

- The motorcycle market in Vietnam has grown briskly since 1999. Between 1999 and 2002, the market size multiplied by nearly six times. Measured by the number of vehicles produced, Vietnam now ranks eighth in the world's motorcycle market. The field of the automobile including the motorcycle is the most active for intellectual property issues in Vietnam. The automobile industry is growing in Vietnam now.
- Vietnam Honda was established in 1996 and started operating in 1997. Equity ownership is 100% Japan. The number of applications for intellectual property such as patents, industrial designs and trademarks has been much more than that of other companies in other fields. (Table 2 in Vietnam National Report) Vietnam Honda has applied for many intellectual properties, and intellectual property has been one of the most important factors for Vietnam Honda's current success.

(Malaysia)

- The number of patent grants for the automotive industry is quite negligible and sporadic. The total number of such patents from 1996-May 2007 came up to only 9. (Fig.8 in Malaysian National Report)
- PROTON is a representative company in the automobile field. PROTON has made several applications for patents, both locally and overseas. However, it has filed vastly more applications for trademarks and industrial designs both in and outside the country. (Table 3 in Malaysian National Report)

3.3 Analysis of reforms that exerted influence on economic development underpinned by the IP system using economic models

(General Remarks)

- As for Impact on IP creation, many positive results are reported. (Japan, China, Vietnam, Malaysia India) According to these results, Impact of the IP system on IP creation is strongly proved here.
- As for Impact on Economic Effects, some positive results are reported. (China, Vietnam, Malaysia) However, some reports do not show positive results. (Korea, India) According to these results, Impact of the IP system on Economic Effects is partially proved here.
- As for Impact on FDI, one positive result is reported. (Malaysia) However, some reports do not show positive results. (Korea, Vietnam, India) According to these results, Impact of the IP system on FDI is singly proved here.

(Japan)

- The number of patent applications filed annually has been stable during the past several years in Japan. Therefore, it is difficult to conduct an economic analysis. However, in Japan, the number of patent applications has been increasing in some local districts. Therefore, in the case of Japan, the economic analysis was focused on local districts.
- Intellectual Property Applications were analyzed before and after the year that the IP strategic Program for each district was introduced. A statistically significant increase was observed in the number of patent filings and the number of trademark filings in the districts that formulated IP strategic programs. (Tables in p.11 and p.12 in Japanese National Report)

(Korea)

- A statistically significant increase was not observed. (Table.1, Table 2 and Table 3 in Korean National Report) Further research is necessary to prove that a relationship exists between IP and Economic Growth, including some approaches such as revising the economic models and finding more appropriate data.

(China)

- As for the Impact on IP creation, “Patent grants” are positively related to the

“IP index” as well as “GDP”.

- As for the Impact on the economy, “GDP” is positively related to the “IP index” as well as to “National Investment in Fixed Assets.”
- The relationship between the IP system and some data related to IP creation and Economic Growth is quantitatively shown from these data. (Tables in page 10 - 13 in Chinese National Report)

(Vietnam)

- As for the Impact on IP creation, “Patent applications” are positively correlated to the “IP index” as well as “FDI.” (p.12 - p.14 in Vietnam National Report)
- As for the Impact on the economy, “GDP” is positively related to the “IP index” as well as to “Private Capital”. (p.12 - p.14 in Vietnam National Report)
- The relationship between the IP system and some data related to IP creation and Economic Growth is quantitatively shown from these data.

(Malaysia)

- As for the Impact on IP creation, “Patent applications” are positively related to the “IP index” as well as to “Private Investment.” (Table 1, Table 2 and Table 3 in Malaysian National Report) The impact on IP creation was suggested in Fig.5 and Fig.9, which were based on the data resulting from this analysis.
- As for the Impact on the economy, “GDP” is positively related to the “IP index” as well as to “Private Investment”. (Table 1, Table 2 and Table 3 in Malaysian National Report) The impact on the economy was suggested in Fig.10, which was based on the data resulting from this analysis.
- As for the Impact on FDI, “FDI” is positively related to the “IP index” as well as to “GDP”. (Table 1, Table 2 and Table 3 in Malaysian National Report)
- The relationship between the IP system and some data related to IP creation, Economic Growth, and FDI is quantitatively shown from these analyses.

(India)

- As for the Impact on IP creation, it was shown that “Patent obtained” and “Patent applied” are positively related to “IP index” as well as “R&D” and “GDP.” (Table 4.1 in Indian National Report) The relationship between the IP system and IP creation was quantitatively proven from these data.

- As for the Impact on the economy, it was shown that “GDP” is positively related to “Capital” and “Labor” but not to the “IP index”. (Table 4.2 in Indian National Report)

- As for Impact on FDI, it was shown that “FDI” is positively related to “GDP” and “Population” but not to the “IP index”. (Table 4.3 in Indian National Report)

4. Discussion and Proposal

(Japan)

- In the part of “Survey on Reforms towards IP-based Economic Development,” we focused on three measures: i) the introduction of the patent system for substances in 1975, ii) the introduction of the Act Promoting Technology Transfer from universities to industry in 1998 and iii) the enactment of the Basic Law on Intellectual Property in 2002. According to the data before and after the introduction of these measures, the number of granted or applied patents, R&D expenditures, technology trades or licensing contracts greatly increased. This means that it is possible that a relation exists between the IP system and economic growth in Japan. It suggests that IP system is one of the success factors for high economic growth in Japan since 1970’s. It is useful for many Asian countries to learn these factors for Japanese success. It is proposed that Japan should explain these results as “Japan’s success cases” not only in Japan but also other countries in Asia.

- In the part of Case Studies on Companies, we focused on four industries related to pharmaceuticals, information technology, machinery and automobile. In the pharmaceutical industry, the royalties of five major companies has increased since around 1999, which seems to have been the result of recent IP policy. Takeda is representative company in the pharmaceutical field, and Takeda’s IP strategy put a higher priority on utilization of IP than application of IP. In the information technology and manufacturing industries, the royalties of five major companies have been stably high or increased since around 1999. Sony and Canon are representative companies in these fields, and they have their own IP strategies such as “patent pool” and “cross-license”. In the automobile industry, R&D expenditure has increased since around 1999, which suggests that new technologies are being aggressively created in this field. Toyota is representative company in the automobile field, and “patent portfolio” is one of IP Strategy of Toyota. It is proposed that Japan should plan the IP Strategic Program for each major technology such as the information technology and biotechnology, because IP strategies are different among technological fields. Also, Japan should advance utilization of IP more than application of IP in order to activate Japanese economy.

- In the part of Economic Analysis, a statistically significant increase was observed in the number of patent filings and the number of trademark

filings in the prefectures that formulated Intellectual Property Strategic Programs. It is proposed that Japan should encourage the local governments to plan Intellectual Property Strategic Programs for their own prefectures, which is expected to be effective on local IP creation and local economic growth in Japan.

(Korea)

- In Korea, the enjoinder to TRIPS is one of the most important reforms towards IP-based economic development. Since the enjoinder of TRIPS in 1995, the number of the patent applications has greatly increased. Moreover, the number of domestic patent applications in Korea has increased much more than the number of applications from foreign countries since 1995. These data suggest that TRIPS has had an effect on IP creation, especially domestic IP creation in Korea. Foreign Direct Investment has increased greatly since 1995. This suggests that TRIPS has had an effect on FDI. In Korea, TRIPS seems to have had an impact on both the domestic economy and FDI. It is proposed that Korea should understand the effects of TRIPS on domestic economy, and advance IP policy based on TRIPS in order to activate economic growth in Korea.

- As for Case Studies on Companies, the number of patent applications and R&D expenditures of SAMSUNG and HYUNDAI have both been increasing these days, which suggests that there is a close relationship between patent applications and R&D. These data suggest that intellectual property and R&D must be one of the important factors for the current success of SAMSUNG and HYUNDAI. It is proposed that the Korean Government should publish these success cases in Korea. it is very useful for Korean companies to learn IP strategy of successful companies.

- As for Economic Analysis in Korea, the results were quite different from what we expected. There is no positive result in Korea. One of the reasons must be that the effects of TRIPS have not been seen because the enforcement of TRIPS is insufficient in Korea. It is proposed that Korea should understand the importance of the enforcement, and advance IP policy including the enforcement, which is expected to have a significant impact on domestic economy in Korea.

(China)

- In China, the enjoinder to TRIPS in 2001 is one of the most important

reforms towards IP-based Economic Development. Patent Application, GDP and R&D expenditure have increased greatly since 2001. It suggests that TRIPS has effects on domestic economy in China. It is proposed that the enforcement of TRIPS should be advanced for further economic growth, as this enforcement is expected to have a significant influence on the domestic economy in China.

- Some major companies such as Huawei and China First Automobile Works Group Corporation have increased the number of patent applications since 2001, when China joined TRIPS. Their revenue has increased, but profit sometimes decreased. The reason is thought that IP was obtained for defensive purposes but not for the utilization. It is proposed that the Chinese Government should advance the utilization of IP for economic growth in China. The development of human resources in IP field is necessary for that, which should be cooperated by WIPO and developed countries such as Japan.
- Some other major companies apply for few patents in China, which means they are weak in innovation and high value-added business. This case is seen in North China Pharmaceutical Group Corporation and Xuzhou Construction Machinery Group. Hereafter, it is important for them to transform themselves from low value-added businesses into high value-added businesses. It is proposed the Chinese Government should advance IP creation as a means for these companies to enhance innovation.
- As for Economic Analysis in China, “patent grants” are positively related to the “IP index” as well as “GDP”. Moreover, “GDP” is positively related to “IP index” as well as “National Investment in Fixed Assets”. The relation between the IP system and economic growth is quantitatively shown from these data. Further research is expected to be conducted for other economic data such as FDI in order to prove the economic impact more clearly.

(Vietnam)

- The introduction of the Civil Code including IP-related provisions in 1995 is one of the most important reforms towards IP-based economic development in Vietnam. The number of patent applications as well as GDP and FDI has increased significantly since 1995. This suggests that there is a close relationship between the IP system and economic growth in Vietnam. Moreover, after the introduction of the Intellectual Property Law in 2006 and

the enjoyment of TRIPS in 2006, the number of patent applications greatly increased. This suggests that the introduction of new IP law in 2006 and the enjoyment of TRIPS in 2006 have had effects on IP creation. It is proposed that the Vietnamese Government should understand the effects of IP system on Vietnam domestic economy, and advance IP policy including enforcement of new IP law and TRIPS. The advancement of IP awareness campaign is also proposed for promotion of enforcement.

- As for Case Studies on Companies, applicants in the automobile industry tend to aggressively apply for IP, but this is not the same situation in other industries. It is proposed that Vietnam should advance IP policy to promote IP activity in companies in Vietnam. One of the measures is to let domestic companies know some successful cases such as Vietnam Honda, and let them understand the importance of IP strategy. The development of human resources in the IP field and the introduction of IT systems in the IP field are also expected to be necessary measures for that.
- As for Economic Analysis in Vietnam, “patent grants” are positively related to “IP index” as well as “GDP.” Moreover, “GDP” is positively related to the “IP index” as well as to the “National Investment in Fixed Assets.” The relationship between the IP system and economic growth is quantitatively shown from these data. Further research is expected to be conducted for other economic data such as FDI in order to prove the economic impact more clearly.

(Malaysia)

- In Malaysia, the enjoyment to the Paris Convention in 1990 and TRIPS in 1995 are very important reforms for IP-based economic development. Since the enjoyment of the Paris Convention in 1990, the number of patent applications and GDP have greatly increased. Since the enjoyment of TRIPS in 1995, the number of patent applications and R&D expenditures have greatly increased. The revision of patent law in 2000 in compliance with TRIPS was also a very important reform for IP-based Economic Development because royalties drastically increased from 2002 to 2005. These data suggest that there is close relationship between IP-related treaties and economic growth in Malaysia. Malaysia joined the Patent Cooperation Treaty (PCT) in 2006, which is also expected to have an influence on the economic growth in Malaysia. It is proposed that Malaysia should advance the enforcement of these treaties in order to activate the domestic economy of

Malaysia. Moreover, Malaysia should understand the effects of IP-related treaties such as TRIPS on domestic economy in Malaysia, and discuss the enjoinder of other treaties, such as the Budapest Treaty.

- As for Case Studies on Companies, even major companies in major industries have not obtained many patents, which is shown by the cases of Favelle Favco Berhad and Cooper Cameron Sdn Berhad in the machinery industry. Under these conditions, it is proposed that the present IP awareness campaign conducted by Malaysian Government be maintained and intensified. The development of human resources in the IP field should be maintained and intensified.
- As for Economic Analysis in Malaysia, "Patent applications" are positively correlated to the "IP index." Moreover, "GDP" and "FDI" are positively related to the "IP index". These analyses prove that the IP system has effects on IP creation and economic growth. It is proposed that the Malaysian Government understand these positive results related to the impact of the IP system on economic growth and advance IP policy. Moreover, Malaysia should try the empirical research more concretely in more specific fields such as FDI in order to prove the impact of IP system more persuasively.

(India)

- In India, the enjoinder to TRIPS in 1995 is one of the most important reforms towards IP-based economic development. In order to be compliant with TRIPS, Indian patent law was revised three times in 1999, 2002 and 2005. Since these revisions of patent law, the number of patent applications, R&D or GDP have increased. These data suggest that TRIPS played an important role in technology development and economic growth in India. Moreover, the number of patent applications has greatly increased since 2003 in India, and the number of Indian domestic patent applications moved ahead of those from foreign countries for the first time in 2004 - 2005. This suggests that TRIPS is also effective in domestic IP creation in India. It is proposed that India should understand the effects of TRIPS on domestic economy and domestic IP creation, and advance IP policy including the introduction of IT systems in the IP field.
- As for Case Studies on Companies, the trend of patent applications is similar to that of R&D expenditures. In the pharmaceutical field and IT field, some major companies have been active in the areas of patent applications and

R&D. However, this is not the case for many companies in India. It is proposed that India should advance IP policy to promote IP activity in domestic companies. One of the measures is to let domestic companies know these successful cases such as Ranbaxy, Dr. Reddy's Laboratories and WIPRO and let them understand the importance of IP strategy. The development of human resources in the IP field is also necessary measures for that.

- As for Economic Analysis in India, "Patent obtained" and "Patent applied" are positively related to "IP index" as well as "R&D" and "GDP." This is a useful result to prove the importance of the IP system in India. Other economic analyses such as "GDP" and "FDA" do not show a positive relationship to the "IP index." One of the reasons for these non-negative results seems to be that the enforcement of TRIPS and IP awareness are insufficient in India. It is proposed that the enforcement of TRIPS and IP awareness should be advanced by the Indian Government, and such measures are expected to have a significant influence on domestic economy in India.

<Reference>

Figures and Tables cited here are shown in respective "Country Report".