

WIPO - UNU Joint Research Project

Impact of the Intellectual Property System on Economic Growth

Fact-Finding Surveys and Analysis in the Asian Region

Country Report – Korea

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1. Introduction

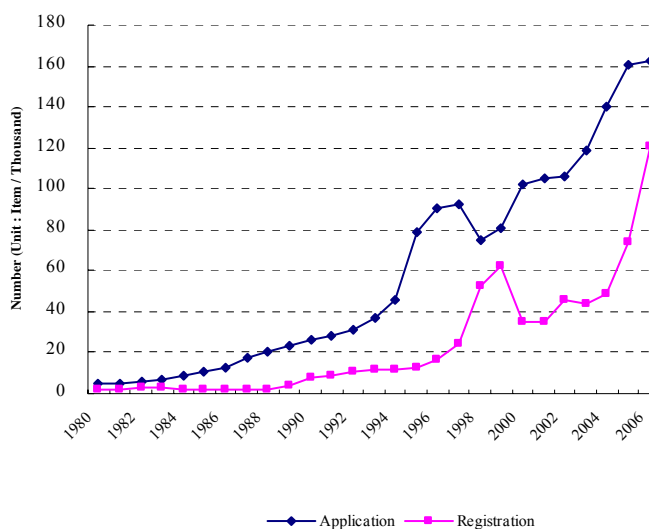
1.1 Outline of the Present Intellectual Property System in Korea

The intellectual property system in Korea includes patent, utility, trademark, design and copyright system. Herein we will mainly handle with the patent system, which has moved towards strengthening patent protection through 30 times of revisions of the Korean Patent Act (Hereinafter as “KPA”) since 1961. In Korea it was needed for stressing the patent system in order to promote rapid industrialization. The recognition on the importance of patent system in Korea can be shown by increase in the number of patent application. According to a report of the WIPO the Korean Intellectual Property Office (Hereinafter as “KIPO”) is the third largest recipient in terms of the number of patent application in 2004, next to Japan and USA, and followed by China and the European Patent Office. Such development of the patent system in Korea was based on not only continuous improvement for removing unreasonable elements, but also efforts complying with international patent systems and principles and harmonizing with them. Such efforts make the patent system in Korea hold following features: (i) to enlarge patentable subject matters; (ii) to increase effectiveness of patent examination; (iii) to strengthen patent protection such as extension of patent protection term; (iv) to control misuse of patent right; (iv) to join international agreements on patent; (vi) to comply with international trend for patent protection etc. Through such revisions of the KPA the patent system in Korea has been internationalized.

1.2 Outline of the Present Economic Situation in Korea

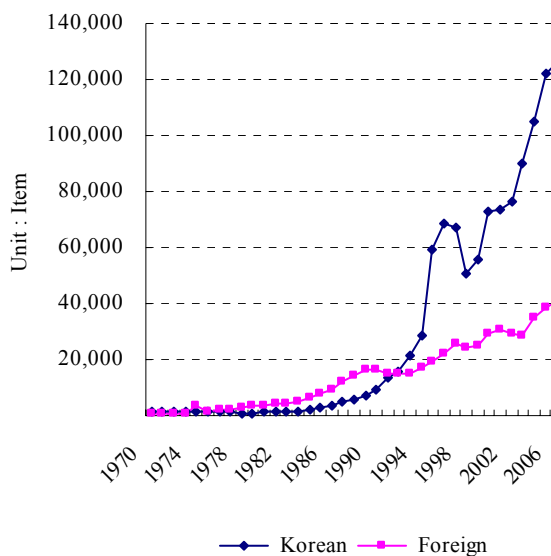
Since 1962, in which the first five-year economic development plan embarked, Korean economy has rapidly begun growing. In particular, it was in the late 1980ties and in the beginning of 1990ties that the Korea’s economy extremely developed. Korea became a member of OECD in 1993. However, the Korea’s economy faced with severe

Graph 1 : Number of Patent Application & Registration in Korea

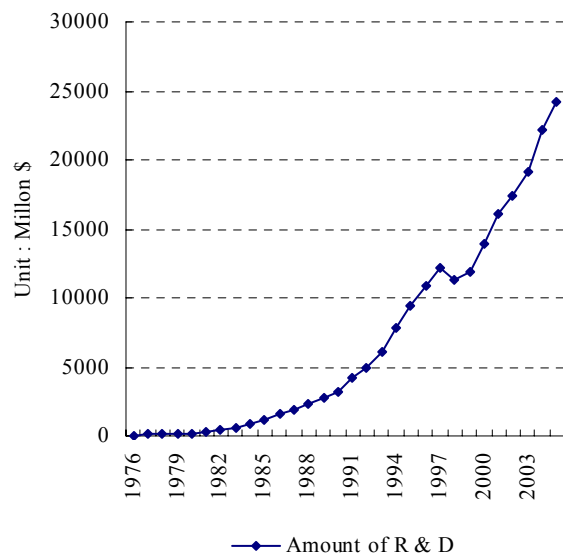


financial crisis called IMF foreign exchange in 1997, in which small, medium-sized as well as large enterprises went bankruptcies. In fact, IMF crisis resulted from not only domestic economy deterioration such as increasing unemployment rate of the youth, debt increase in household economy, contraction in investment of enterprises, credit card delinquencies and so on. Those days international economy around Korea was bad as well, for example, rise of international oil price, financial retrench conditions of China, tardiness of economy recovery in developed countries. The influence of IMF crisis went on till 2002, and the Korea's economy seemed to fall down the bottomless pit. During the period of IMF crisis the number of patent application and total R&D in Korea were decreasing (See Graph 2 and Graph 3). In particular, total R&D in Korea has been extremely increasing since 1988 except IMF crisis (Graph 3). However, the Korea's economy has been recovering again without the seeming eternity. Since 2002, in which the World Cup Football Game was hold in Korea and Japan, economic indicators in Korea have been going up again, the trade balance has improved, and patent applications also increased, as verified by statistical numerical values.

Graph 2 : Patent Applications Trends



Graph 3 : Total R & D in Korea



2. Survey on Reforms towards IP-based Economic Development

2. 1 Brief History of Intellectual Property Laws and Policies in Korea

The patent system in Korea was not established by Korean government, but forced by some World Powers in the beginning of 20th century in order that they would protect foreign patent rights for holding a dominant position in the market. At first, “Agreement between U.S. and Japan for protecting invention, design, patent and copyright in Korea” was concluded by which the Korean Patent Ordinance was promulgated as of 12th August 1908. It was annulled as of 29th August 1910 when Korea was annexed by Japan, and instead the Japan Patent Act was put in force in Korea. Korea became an independent country after World War II. Afterwards, a Patent Act came into effect as a part of the Industrial Property Act by Art. 91 American Military Government Ordinance. It was not in 1961 until Korea enacted a Patent Act of its own, whose structure was similar to that of Japan and the U.S. Since 1961 the Korean Patent Act (hereinafter KPA) has been revised around 30 times including partial revisions, by which Korea forwarded industry-promoting policies.

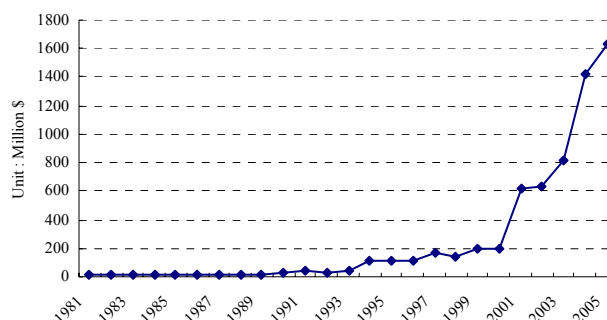
In the meantime, the patent system in Korea has moved towards enlarging patentable subject matters, raising efficiency of examination and judgment at the KIPO, simplifying procedures at the KIPO, strengthening patent protection, controlling misuse of patent right, joining international treaties etc. In particular, the number of unpatentable subject matters has been reduced, and the current KPA has only a regulation as follows: patents shall not be granted in respect of inventions the publication or exploitation of which would be contrary to ordre public or morality, or be harmful to public health. Besides, the patent system in Korea is globalized through joining international treaties, for example joining Paris Convention in 1980, PCT in 1984, Budapest Treaty on the international Recognition of the Deposit of Microorganism for the Purposes of patent procedures in 1988, TRIPs in 1995, and UPOV in 2002. In addition, substance patent system was introduced in 1986 under commercial pressure from the U.S., which resulted in granting patents for chemical substances as well as medicines. Meanwhile, the KIPO made its own guideline relating to biotechnology invention in 1998 by which patents for inventions on human gene, plant, and animal could be granted as well. The KIPO also established a special guideline on business model patent in 2000, which made it possible to grant a patent for invention concerning business model. The present patent protection level in Korea can be said to be almost similar to that of developed countries.

2.2 Identification of Reforms towards IP-based Economic Development

Herein major reforms that have had important influences upon economic development in Korea will be identified. There were, roughly speaking, three important changes which have influenced the number of patent application and registration since 1980ties in Korea: introduction of substance patent system in 1986, joining TRIPs in 1994, and IMF financial crisis in 1997. Since the KPA has been revised to grant patents for inventions on chemical substances in 1986, the number of patent application largely increased from 12,759 in 1986 to 17,062 in 1987. Afterwards, the number of patent application rose by approximately 2,000 to 3,000 every year until 1993. In 1994 Korea joined WTO/TRIPs which came into effect 1st January 1995. In particular, for three years from 1994 to 1996 the number of patent application increased on a large scale with priority given to IT and automobile industries. However, the Korea's economy was in severe jeopardy in 1997, called as IMF crisis. IMF crisis seemed to have negative influence upon R&D investment of Korea's enterprises, and resulted in a big decrease in the applications of industrial property, particularly in the areas of automobile, machinery and IT. However, the pharmaceutical area did not largely undergo influence by worse economy. Thanks to the whole nation's efforts to overcome IMF crisis Korea's economy has begun recovering, and showed an increase more than 6% per year from 1999 to 2002, which had certainly influence on the area of intellectual property. For example, the number of patent application has begun increasing again. It is noteworthy that patents for inventions on biotechnology could be granted from 1998 according to the Examination Guideline on Biotechnology of the KIPO, and that patent applications in the biotechnology area have been continuously increasing. For example, 1,891 patent applications in this area, including 1,030 by Koreans and 861 by foreigners, were filed at the KIPO in 1999, and 1,264 patents were granted.

With regard to benefits from technology export Korea has gained royalties mainly from China and the U.S., followed by some east-Asian countries including Indonesia,

Graph 4 : Royalties obtained from Technology Export



Malaysia, India. Korea did not make profits from technology export during 1978 to 1996, but it was since 1997 that technology transfer to foreign countries has been actively performed (See Graph 4) In particular, Korea has gained lots of royalties since 2003; it almost corresponds with the year in which Korea's domestic economy was recovering, which shows the relationship of royalties from technology transfer with IP protection.

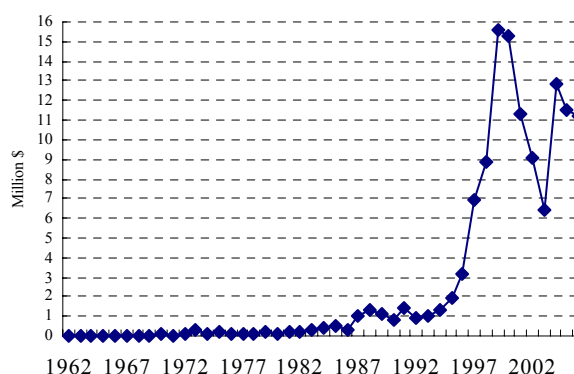
Besides, foreign direct investment (FDI) certainly relies on economic situation of each country. FDI in Korea decreased a little in 1998, but largely from 2000 to 2003 (See Graph 5). During this period FDI largely dropped to almost 60%. In those days foreign investors might have thought that Korea still had faced with financial problems even

though its economy was, indeed, slowly recovering. FDI increased two times in 2004 in compared with 2003, which means that foreign investors thought that the Korea's economy has begun reactivating again after going through the IMF financial crisis. On the other hand, the number of patent application from 2001 to 2003 did not decrease, but even increase a little. Therefore, FDI does not seem to be necessarily proportional to the patent application.

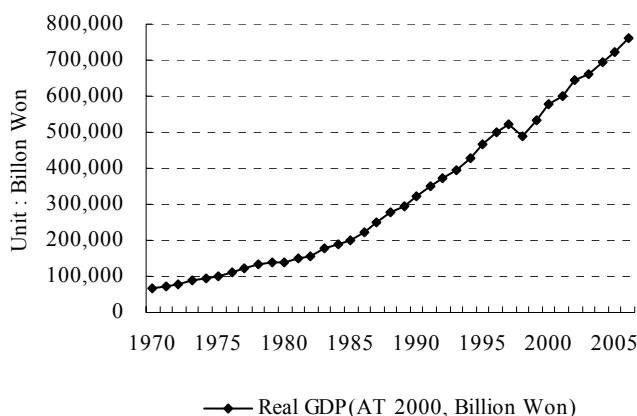
As to GDP (Gross Domestic Product) Korea was in the worst in 1998, but GDP went up in 1999. Since then the graph of GDP was not constant,

but went on dropping until 2003, except for the period of 2001 to 2002 (See Graph 6). Taking into consideration of the relationship of GDP with domestic economy, GDP seems to be largely related with domestic economy, and so closely related to IP protection.

Graph 5 : FDI(Foreign Domestic Investment)



Graph 6 : Real GDP(AT 2000)



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

3.1 Comparison of Company Data among major Industrial Fields

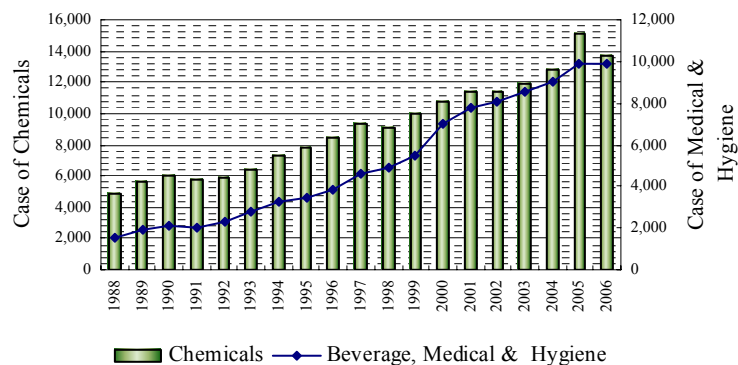
In the report, four areas are selected, namely pharmaceutical, automobile, machinery and IT area (See Graph 7 & 8). Two companies in each industry are chosen, and some features in each industry will be shown.

The selected two companies in the pharmaceutical field are DONG-A and YUHAN corporations. The pharmaceutical field shows following features: First, the number of patent application in this field

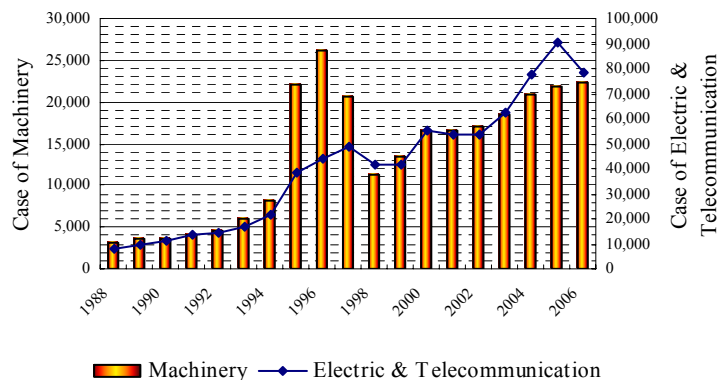
is much fewer than that of other industries such as automobile and IT (See Graph 9). Second, the number of patent application in the area was not almost influenced by external bad factors such as IMF crisis. Third, two pharmaceutical companies have been constantly spending in R&D irrespective of external factors (See Graph 10).

The automobile field indicates as follows: First, although selected motor companies KIA and HYUNDAI are representative companies in this field, they appeared to be very negative in filing patent applications in the early 1990s. Second, the number of patent application in this area

Graph 7 : Number of Patent Application in each industry(1)
(The source : The Korean Intellectual Property Office)
Unit : Item

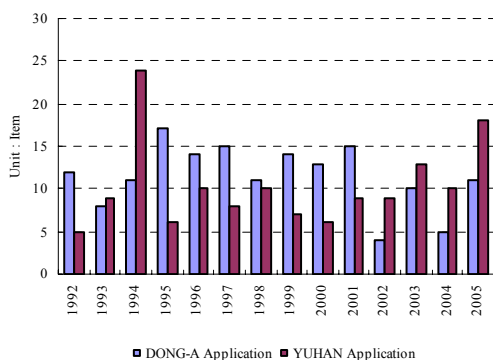


Graph 8 : Number of Patent Application in each industry(2)
(The source : The Korean Intellectual Property Office)
Unit : Item

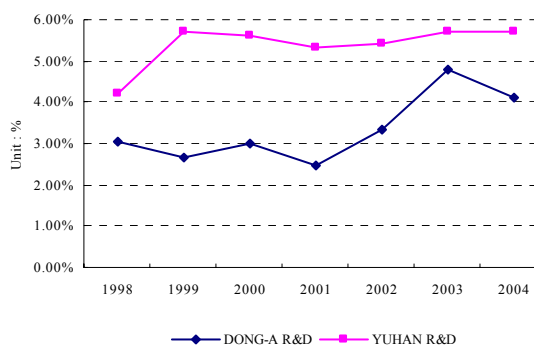


was vastly increased only before and after TRIPs. Third, KIA Motor Company faced with dishonor in 1997 when IMF crisis occurred, and since then its number of patent

Graph 9: Patent Application of DONG-A & YUHAN



Graph 10 : R&D of DONG-A & YUHAN



application has been very few. However, its R&D investment ratio has slowly increased since 1998. Fourth, HYUNDAI Motor Co. had also difficulties in management around 1997, but the number of its patent application increased in 1999. Since then its growth rate has been almost hesitated. In the meantime, R&D investment ratio of HYUNDAI Motor Co. rapidly decreased from 1998 to 1999, and slowly went down till 2002, but has increased since 2002. During the IMF crisis the number of patent application of HYUNDAI was largely decreasing, but since 2000 the number of patent application has begun recovering, and its IP strategy tends towards strengthening intellectual property since then, because the number of patent application as well as R&D has been slowly increasing.

The machinery field shows as follows: First, the number of patent application of the selected large enterprises DOOSAN Infracore and HYUNDAI Heavy Industries seemed to be highly influenced by domestic economy. Second, the number of patent application of DOOSAN Infracore increased from 1992 to 1996, but since then heavily went down around IMF crisis. R&D investment ratio of DOOSAN Infracore dropped from 2000 to 2004, but then has been slowly rising. Third, the number of patent application which HYUNDAI Heavy Industries filed shows to steadily increase by 1997, but then largely dropped. On the other hand, its R&D investment ratio increased only from 1998 to 1999, and then hesitated.

Finally, in the IT area two representative companies SAMSUNG Electronics and LG Electronics are selected. First, the number of patent application filed by SAMSUNG Electronics vastly dropped from 1997 to 2000, which was badly influenced by IMF crisis, and afterwards, it has heavily increased. It is also characterized by which its R&D investment ratio went down from 2000 to 2002, but since then has been slowly going up till 2006. Second, the number of patent application of LG Electronics slowly

increased from 1992 to 1997, and remarkably increased from 1998 to 2004, but then has decreased. Its R&D investment ratio is between 4.0 and 5.40 % from 2002 to 2006.

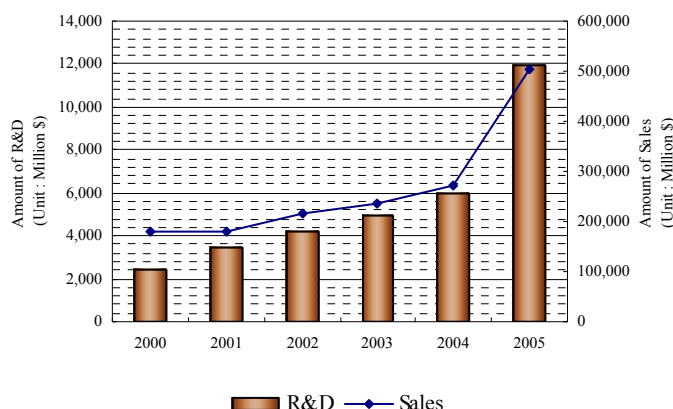
3. 2 Results of Analysis

The research on the number of patent application over industries shows that it is certainly different over industries on whether external factors such as IMF crisis had influences upon the patent policy of each company. For example, the number of patent application in the pharmaceutical field constantly increased even during IMF crisis. In other words, the pharmaceutical field does not seem to be affected a little by IMF crisis.

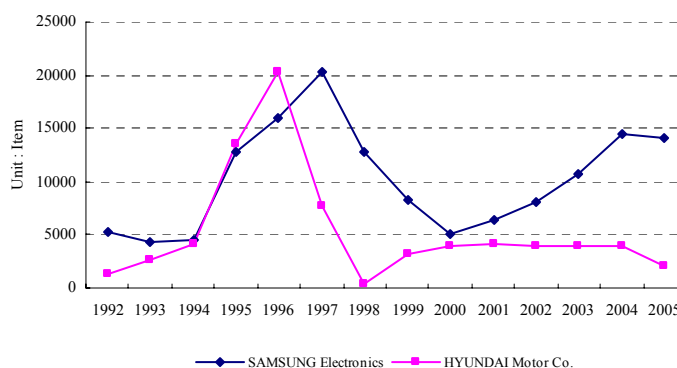
On the other hand, automobile and machinery industries are somewhat different in this respect. The number of patent application in the fields of automobile and machinery has been positively influenced by TRIPs, and negatively by IMF crisis. In particular, the number of patent application in the automobile area largely dropped in 1997 and 1998, but has very slowly increased since 1999. Besides, the number of patent application in the machinery area dropped down in 1997 and 1998 as well. However, it has been constantly increasing since 1999, and largely increasing since 2004. From these results we deduced that patent applications for both automobile and machinery areas seem to be closely related to domestic economic situation.

IT industry has recently vastly developed in Korea, playing a tremendous role in

Graph 11 : Trend of R&D and Sales in IT field
(The source : The Bank of Korea)

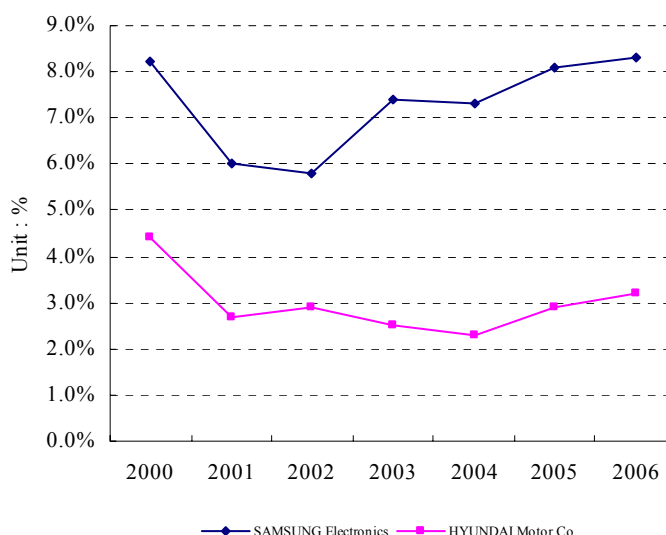


Graph 12 : Number of Patent Application in SAMSUNG Electronics & HYUNDAI Motor Co.
[The source : Korea Institute of Patent Information]



developing Korea's economy. According to the research result IT industry was also somewhat affected by external factors such as IMF crisis, and so the number of patent application was decreased both in 1998 and 1999, but a little. It slowly increased from 1999 to 2003 with a gentle growth slope, and has been exceedingly increasing since 2003. In terms of biotechnology invention, it is noteworthy that domestic applicants have filed almost two times

Graph 13 : R&D Ratio of SAMSUNG Electronics & HYUNDAI Motor Co.
[The source : Korea Institute of Patent Information]



more patent applications since 2002 rather than foreigners. We assume that lots of cost and labor forces have been invested into R&D on biotechnology from the beginning of 21 century.

Meanwhile, the data about R&D and sales are, unfortunately, given since 2000 on average. Although R&D and sales in four fields have continuously increased during this period, the analysis shows that R&D and sales in the IT field have extensively increased since 2004, followed by automobile, machine, pharmaceutical field. This research shows that IT industry has been the most important field among Korea's industries since 2000 with respect to the number of patent application as well as R&D and sales (See Graph 11). On the other hand, R&D investment ratios are so different over industries and companies that we may not mention about them in a word. For example, R&D ratio of DONG-A pharmaceutical company highly increased from 2001 to 2003, while R&D ratio of DOOSAN Infracore decreased during the same period. Additionally, it is noticeable that SAMSUNG Electronics has invested the most cost into R&D among all eight companies since 2000, and its number of patent application has been increasing since then (See Graph 12 and 13), and that R&D investment ratio of KIA Motor Co. in the field of automobile has continuously increased. Such results demonstrate that selected each company has its own R&D and patent policy which seems to be affected by domestic economic situation. In fact, it is inconvenient not to obtain more time-series data about R&D investment ratio over companies.

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

4.1 Establishing the Economic Models

(1) Impact on IP Creation

This report presumed following model (A) using time-series data from 1976 to 2005 in order for analyzing on whether IP creation has influence upon the number of patent application and registration. The reason why the number of patent application and registration is added herein is that we assumed the number of patent application or registration may be affected by R&D or GDP.

$$\ln P = c + \alpha_1 \ln RD + \alpha_2 \ln GDP + \alpha_3 \ln IP + \varepsilon \quad (A)$$

where P is the number of patent application or registration, IP is intellectual property index, and ε is error term.

On the other hand, we presumed following model (B) including R&D and IP index in order to analyze on whether royalties from technology export affect the number of patent application and registration.

$$\ln P = c + \gamma_1 \ln RD + \gamma_2 \ln Benefit + \gamma_3 \ln IP + \varepsilon \quad (B)$$

where Benefit is royalties from technology export.

(2) Impact on Economic Effect of Business Activities

Herein we have used the protection function approach for analyzing on whether capital stock, labor and intellectual property have influence upon GDP or not. The period for analysis is 1972 to 2000.

$$\ln GDP = c + \beta_1 \ln K + \beta_2 \ln L + \beta_3 \ln IP + \varepsilon \quad (C)$$

where K is net capital stock, L is the number of employed persons.

(3) Impact on Foreign Direct Investment

Herein both GDP and population are calculated as variables, and we presumed the model (D) using time-series data from 1971 to 2006 in order for analyzing on whether IP has influence on foreign direct investment or not.

$$\ln FDI = c + \delta_1 \ln GDP + \delta_2 \ln POP + \delta_3 \ln IP + \varepsilon \quad (D)$$

where FDI is foreign direct investment, and POP is total population.

4.2 Results of Analysis

First of all, we would like to say that we used the published data at KIPO concerning the number of patent application and registration, and the data at the Ministry of Science and Technology (MiST) relating to total domestic R&D. GDP is provided by the Korea National Statistical Office (KNSO) in 2000. We offer IP Index from 1961 to 2006 calculated using the same methodology from Ginarte & Park(1997). Unfortunately, Korea's IP index in Ginarte & Park(1997), which seemed to be wrong calculated with respect to signature year to international treaties and misunderstandings for Korea's patent systems, is, however, different from IP index we calculated. Royalties from technology export are provided by the Ministry of Commerce, Industry and Energy(MiCIE). The data on capital stock is offered by net capital stock of Pyo(2003)'s article, and the data on labor provided by the number of employed persons at the KNSO. The data on FDI is offered by the MiCIE, and population by the KNSO. In addition, all variables are changed into log values.

Table 1 shows the results to estimate the model (A). First of all, the value of R^2 is approaching to 1, which means that the model (A) is reliable. Among factors affecting the number of patent registration the estimated value for R&D is 0.841, and t-value equals 15.6. However, it shows that R&D is of little effect when both GDP and IP index are together included in the regression equation. IP index is even negative in the number of patent registration. On the other hand, as a dependent variable the number of patent application is positively affected by R&D, but R&D has little influence upon the number of patent application when other explanatory variables such as GDP and IP are included. In this case GDP positively affects the number of patent application, while IP index is not statistically significant, but shows negative sign. Therefore, the result demonstrates that the stronger intellectual property is, the more negative effect the number of patent application and registration has.

Table 2 shows the results assumed by the model (B). The value of R^2 in the model (B) is also close to 1, meaning that the model (B) is reliable. It shows that royalties obtained from technology export and R&D have positively influences upon the number of patent registration. It is remarkable that R&D has still influence on the number of patent registration, although other explanatory variables are included. By the way, IP

index is not statistically significant, but has a negative sign so that the result of the model (B) may be similar to that of the model (A). On the other hand, the number of patent application is positively affected by R&D, but is not concerned with royalties obtained from technology export as expected.

Table 3 shows the results including explanatory variables such as labor, capital stock, GDP, POP and IP index. The model (C) is highly reliable because the value of R^2 in the model (C) is very close to 1. When estimating production function capital production elasticity is 0.394, and labor elasticity 0.709, and both are statistically significant. IP index in the model (C) has positively influence on GDP, which means that strengthening of intellectual property positively affects on the productivity in Korea. Although GDP positively affects on FDI, IP index does not influence on FDI. This means that the enforcement of intellectual property does not draw FDI.

[Table 1] Estimation results: Impact on IP Creation

Explanatory Variables	Model (A) Dependent variable: number of patent registration			Model (A) Dependent variable: number of patent application		
Constant	0.265 (0.478)	-24.78*** (2.76)	-26.29*** (3.25)	2.962*** (11.7)	-18.17*** (8.15)	-18.22*** (8.02)
ln(RD)	0.841*** (15.6)	-0.050 (0.157)	0.314 (0.983)	0.706*** (28.7)	-0.046 (0.57)	-0.034 (0.38)
ln(GDP)		2.699*** (2.80)	2.879*** (3.30)		2.276*** (9.49)	2.282*** (9.33)
ln(IP)			-3.294*** (2.71)			-0.105 (0.30)
R^2	0.896	0.919	0.937	0.967	0.992	0.992

Notes: 1. t-values are in parentheses.

2. ***(**, *) indicate significance at the 1% (5%, 10%) level, respectively.

[Table 2] Estimation results: Impact on IP Creation (continued)

Explanatory variables	Model (B): Dependent variable: number of patent registration			Model (B): Dependent variable: number of patent application		
Constant	-1.424 (1.58)	1.839 (1.59)	1.018 (0.65)	1.27*** (5.64)	1.639*** (4.61)	1.179*** (2.59)
ln(RD)	0.991*** (12.0)	0.549*** (3.94)	0.839** (2.18)	0.857*** (41.3)	0.807*** (18.9)	0.971*** (8.55)
ln(Benefit)		0.357*** (3.61)	0.273* (1.89)		0.039 (1.31)	-0.007 (0.17)
ln(IP)			-1.358 (0.80)			-0.762 (1.54)
R ²	0.867	0.917	0.920	0.987	0.988	0.989

Notes: 1. t-values are in parentheses.

2. ***(**, *) indicate significance at the 1% (5%, 10%) level, respectively.

[Table 3] Estimation results: Impact on Economic Effects of business activities, Impact on Foreign Direct Investment

Explanatory variables	Model (C) Dependent variable: ln(GDP)	Model (C) Dependent variable: ln(FDI)
Constant	-0.013 (0.01)	472.03*** (2.99)
ln(K)	0.394*** (5.77)	
ln(L)	0.709** (2.00)	
ln(GDP)		5.381*** (3.31)
ln(POP)		-30.23*** (3.01)
ln(IP)	0.369*** (2.99)	2.196 (1.18)
R ²	0.995	0.665

Notes: 1. t-values are in parentheses.

2. ***(**, *) indicate significance at the 1% (5%, 10%) level, respectively.

5. Discussion and Proposal

The article handles with the impact of intellectual property system on economic growth in Korea through empirical analysis. Indeed, granting a patent for an invention relies upon industrial patent policy of each country. For example, exceptions to patentability may be different according to industrial development or technical standard of the country. With this regards regulations concerning exceptions to patentability in Korea have been rescinded over years, and the KPA has been revised for expanding patentable subject matters. It is remarkable that such revisions have been recently carried out, in particular, in the area of IT and biotechnology. Based upon these revisions of the Patent Act the current Korean patent system has been globalized.

With respect to patent application and registration Korea has made great strides, in particular since 1990ties. As above-mentioned in Part 4, the analysis on the impact of intellectual property system on economic growth demonstrates that both R&D and GDP have close relationships with the extent of patent protection in Korea. There seems to be relation between IP system and GDP because of Graph 1 and 6, which is also shown by economic analysis (See Table 1). In addition, it is interesting to say that there seems to be any relation between IP system and IP creation between Graph 1, however economic analysis could not show this relation. On the contrary, the economic analysis shows that the number of patent registration is almost in inverse proportion to IP index (See Table 1). In other words, the stronger IP protection in Korea is, the more negative the number of patent registration or application is.

Besides, reinforcement of intellectual property system in Korea ultimately appears to show promotion of technology transfer (See Graph 4). Going into more details, royalties from technology exports are shown to be related to the number of patent registration, not patent application (See Table 2). It is caused by which technology transfer to foreign country is mainly carried out using registered patent right, not in the patent application. Furthermore, it is noteworthy to say that there seems to be any relation between IP system and FDI because of Graph 1 and 5, however economic analysis could not show this relation (See Table 3). On the contrary, economic analysis shows that strengthening IP protection in Korea does not concern with FDI.

According to the economic analysis it is shown that a policy to strengthen IP protection in Korea has positive influence on technology transfer, R&D and GDP, but not FDI. In addition, strengthening IP protection in Korea does not concern with the

number of patent application or registration. Taking into consideration into these results of economic analysis we suppose that various political measures are still needed for maximizing positive effects of economic growth by strengthening IP protection in Korea. As to intellectual property policy in Korea the more open-door policy should be adopted so that IP protection here may reach the protection level of developed countries.

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