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 – Malaysia

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1. Introduction

It has been constantly asserted that the intellectual property system is an effective way to enhance creativity, promote technological innovations, improve trade and enhance competitive positioning. Others, however, maintain that the IP system may not necessarily be the most effective and appropriate way to fuel the economy. The aim of this research is to ascertain objectively, through empirical research, the role which intellectual property plays in the economic development of Malaysia.

The research project focuses on areas particularly relevant to the economic impact of IP on developing countries. The major IP law reforms that are expected to give an important influence on economic development are identified. Company-level case studies are conducted to ascertain the impact of these reforms on companies. Where possible, the target corporations are chosen from among the top 10 applicant companies in the country in relation to industries selected for the study, i.e., from the pharmaceuticals, automobiles, information technology and manufacturing industries.

Based on specific case studies, the economic effects brought about by the IP system is examined. As economic development cannot be due exclusively to the IP laws, other IP related policies are also examined to determine the impact of all these policies, working in tandem with the IP system, on economic development in Malaysia. In relation to the patenting trend as an indication of economic activities, the trends in the numbers of application filings/registrations by domestic applicants are analysed. From the various statistics collected, an analysis of reforms that exerted influence on economic development is examined using economic models, based on their impact on IP creation, economic effects on business activities and on foreign direct investments.

2. Brief History of the Malaysian Intellectual Property System

The first copyright statute applicable to the whole of Malaysia was the Copyright Act 1969. The 1969 Act repealed the various copyright statutes which applied to different parts of the component states of Malaysia. Hence, by the Copyright Act 1969, all the components states of Malaysia were, for the first time, governed by a single copyright legislation. The 1969 Act was replaced by the Copyright Act 1987, which came into effect on 1 December 1987. The Copyright Act 1987 was further amended in 1990, 1996, 1997, 2000, 2002 and 2003 to cater to developments in the international arena.

The patent law of Malaysia is presently governed by the Patents Act 1983, which came into effect on 1 October 1986. Prior to the 1983 Act, different component states of Malaysia were governed by different pieces of patent legislation. The different legislation that were repealed by the 1983 Act were the Registration of United Kingdom Patents Act 1951, the Patent Ordinances of Sarawak, the Registration of United Kingdom Patent Ordinance of Sabah and the Patents (Rights of Government) Act 1967. The Patents Act 1983 was further amended in 1993, 2000, 2003 and 2006.

The Trade Marks Act 1976 repealed all the previous legislation and applies throughout the whole of Malaysia. The statutes that applied to the different component states of Malaysia that were repealed were the Trade Marks Ordinance 1950 for the Federation of Malaya, the Trade Marks Ordinance of Sabah and the Trade Marks Ordinance of Sarawak. The Trade Marks Act 1976 was further amended in 1994 and 2000.

Prior to the present Industrial Designs Act 1996, there were three different sets of law relating to industrial designs in Malaysia. There were the UK Designs (Protection) Act, 1949 for West Malaysia, the UK Designs (Protection) Ordinance for Sabah and the Designs (UK) Ordinance for Sarawak. All these legislation employ the "extension" system, wherein registration of a design in the United Kingdom would entitle the proprietor to a monopoly to the design in these various relevant component states. In 1996, all the above legislation were repealed and replaced by the Industrial Designs Act 1996. After the coming into force of this statute, an applicant has to register his design in Malaysia before he could claim any monopoly rights in that design.

In addition to the above, the Optical Discs Act 2000, the Layout-Designs of Integrated Circuits Act 2000, the Geographical Indications Act 2000 and the Protection of New Varieties of Plants 2003 were also enacted.

3. The Malaysian Economy Since Independence

The Malaysian economy before independence was predominantly based on agriculture and mining. After independence, the Government realised the need for a diversified and industrialized economy and thus it embarked on the drive towards sustained growth through several industrialization phases.

Through these strategies the economy grew extensively. The manufacturing sector's contribution to GDP grew from 8% in 1957 to 13% in 1970, 17% in 1980, and 25% in 1990 and by 2006 the sector accounted for 32% of GDP (see Figure 1). The share of manufactures in total export rose from 9% in 1970 to 22% in 1980 and 47% in 1987 before shooting up to 75 % in 1990. Between 2001 and 2005, the share was above 80%. The major contributor is the electrical and electronics sector which accounted for 28% of the manufacturing sector value added and 64.1% of the total exports of manufactured exports in 2005 (see Figure 2).

Fig. 1: Contribution to GDP, 2005 (%)

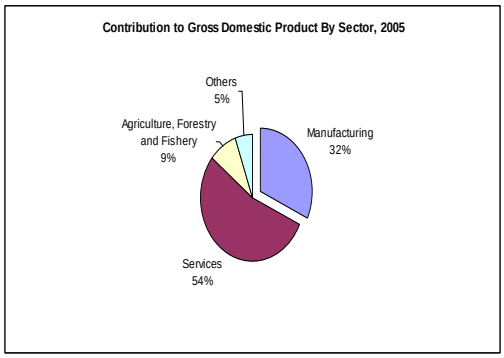
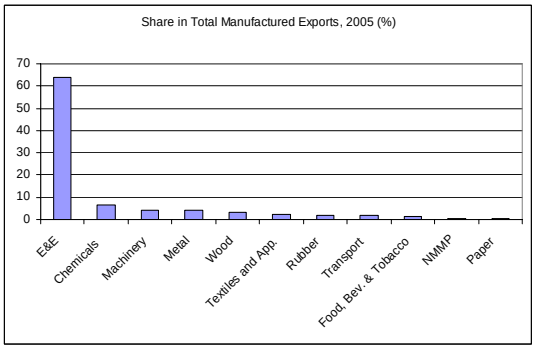


Fig. 2: Share in Total Manufactured Exports by Industrial Sub-Sectors, 2005 (%)



The government has recently emphasized on transforming the manufacturing sector to focus on high value added and knowledge-intensive industries. The main concern is to shift from input-driven to productivity-driven growth to garner a higher contribution from total factor productivity.

4. Reforms Towards IP-Based Economic Development

4.1 Reforms in Intellectual Property Law that May Impact on Economic Development

The reforms identified here are not exhaustive as only those that may have impact on IP creation and economic development are selected and examined.

Patents **:** The most important is the enactment of the Patents Act 1983 which, for the first time, enables applications for patents to be made domestically instead of to the Patent Office of the United Kingdom. This Act also introduced the utility innovations system to protect inventions which may not be patentable since they do not satisfy the requirement for inventive step. Another reform was brought about by the Patents (Amendment) Act 1993 which aims to encourage research in the medical field. By this amendment Act, purpose bound product claims for medical use are allowed even in relation to a known product.

The 1993 Amendment Act introduced an important innovation. Applicants who had previously applied for a patent in relation to the same invention at the patent offices of Australia, the United Kingdom, the United States and the European Patent Office could now opt for a modified substantive examination instead of having to undergo a full substantive examination. This facility was further extended to applications filed at the Patent Offices of Japan and the Republic of Korea in 2002 and 2003 respectively.

The Patents (Amendment) Act 2000 brought about several changes to the patent law to ensure compliance with the TRIPS Agreement. An important reform which is beneficial to generic drug manufacturer was the exemption from infringement proceedings for the use of a patented product during the patent term for the purpose of obtaining regulatory approvals for pharmaceutical products. The Patents (Amendment) Act 2003 also added a new Part XIV to the principal Act, containing provisions relating to international applications under the Patent Cooperation Treaty.

Copyright, Trade Marks, Industrial Designs and other Statutes**:** The most important reforms in relation to the ICT industry is the specific inclusion of "computer programs" as a literary work under the Copyright Act 1987. The Trade Marks (Amendment) Act 1994 provides for registration of service marks. In line with the obligations under the Paris Convention, provision for a right to claim priority for Convention applications was added. The important reform in relation to industrial design law is the enactment of the Industrial Designs Act 1996, allowing for application and grant of industrial designs to be made locally. The Layout-Designs of Integrated Circuits Act 2000 is significant as the owner of a new layout design is now protected under a *sui generis* statute instead of having to rely on the uncertain scope of protection under the copyright law.

4.2 Industrial Policies

The industrial sector in Malaysia has been the key sector in the economic development of the country. The industrial strategies went through four distinct stages since 1960s.

The first phase focused on substituting imports where generous incentives such as tariff protection, fiscal measures (mainly tax relief) and provision of infrastructure in the form of industrial estates, power and communications were granted to manufacturers. Though successful in stimulating the sector, in terms of contribution to GDP, the strategy failed to create employment.

This prompted the Government to switch to an Export-Oriented Industrialisation strategy (EOI) to generate high economic growth and create employment opportunities. Various incentives were created, such as the Investment Incentives Act 1968 which was specifically formulated to encourage foreign investors into export-orientated industries. Free Trade or Export Processing Zones were created and manufacturers were given generous incentives such as tax holidays, tariff exemptions on inputs, infrastructural facilities, investment credits and tax-free remittances of profits and dividends. These measures resulted in leading foreign electronics companies to invest in Malaysia.

However, the dependence on a narrow range of products and the lack of linkages with the domestic economy made the Government to move into the third phase of industrial strategy in the early 1980s. Attention now switched to the automotive, cement and steel industries. However, by the end of 1980s, it was realised that the link between the heavy industries and the export-oriented sectors was absent. Dependence on foreign technology and investment remained high.

Thus, from 1986 onwards, the Government came up with Industrial Master Plans which provide long-term indicative plans for the development of specific sub-sectors. Export-oriented industries and foreign investment were further promoted. The biotechnology and services sectors are given emphasis to boost R&D and technology development.

4.3 Science and Technology Policy

The S&T policy is formulated to accelerate industrial development, stimulate IP creation and promote the ICT and bio-technology sectors. One of the focuses of the 7th Malaysia Plan (1996-2000), and followed up in the 8th Malaysia Plan (2001-1005), is the building of indigenous technological capability in new enabling technologies. The emphasis was placed on accelerating R&D and the amount of money disbursed for R&D has been steadily increased (see Figure 3).

Fig. 3: National R&D Expenditure as % of GDP, 1992-2002

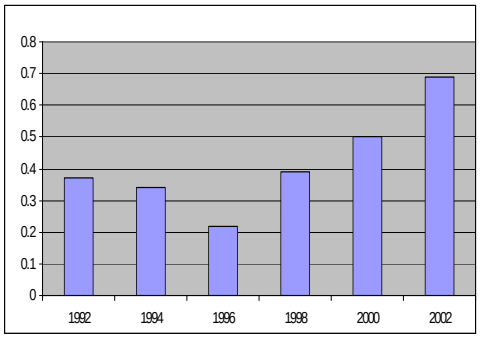
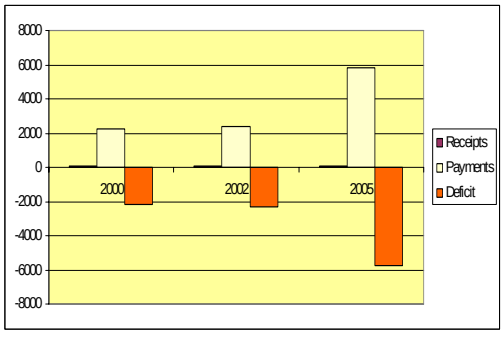


Fig. 4: Royalty Payments, 2000-2005 (RM Million.)



Incentive schemes included double deduction expenditure incurred for R&D, pioneer status for companies involved in R&D and investment tax allowance of up to 100% of qualifying expenditure. To promote commercialisation of R&D in agriculture by the private sector, a fund of RM300 million was established in 2005.

In the 9th Malaysian Plan (2006-2010), the development thrust of the S&T policy is to adopt a holistic approach to strengthen the National Innovation System (NIS). One target is to intensify indigenous capacity building in key technologies through the creation of special funds for R&D in selected sectors such as biotechnology and ICT. For this the National Biotechnology Policy was launched in 2005 and the National IP
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Policy launched on 27th April 2007. The targets are to increase the national R&D expenditure to 1.5% of GDP by 2010, to increase researchers, scientists and engineers to 50 per 10,000 labour force in 2010 and to promote techno-entrepreneurship and technology-based enterprises. One key concern raised was the apparent imbalance in technology inflow and outflow (see Figure 4).

4.4 Impact of IP-Based Policies on Trends in Patent Applications

Since the implementation of the Patents Act 1983, there has been a gradual increase in the number of patents filed in the country. The increase is more apparent in the 1990s, where the total number of application has been consistently in the region of 4-6 thousand yearly since 1993. This could be attributed to Malaysia's accession to the Paris Convention in 1990 which enables foreign applicants to claim priority based on their earlier filing dates. Another factor could be due to the introduction of the modified substantive examination facilities for applicants originating from certain foreign patent offices in 1993, 2002 and 2003 (see Figure 5).

Patent Applications by Country of Origin

Foreign patent applications constitute a large share of the total patent applications in the country (more than 90%)(see Figure 5). The total number of applications by all top 10 applicants has increased over the years. Filings from the US constitutes one third of the total cumulative patents applied for between 1986 and May 2007. The second largest foreign applicant is Japan (19%) followed by Germany (7.5%) and United Kingdom (6.2). Malaysian applications rank fifth accounting for 5.5% of the total number of patent applications (see Figure 6). It is noteworthy that the US and Japan are the top two sources of FDI in Malaysia for the past years (see Figure 7).

Fig. 5: Patent Applications by Nationality (1986-2006)

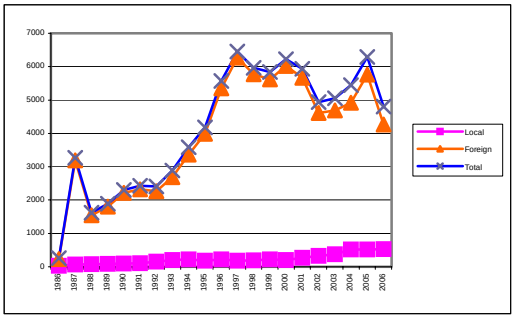
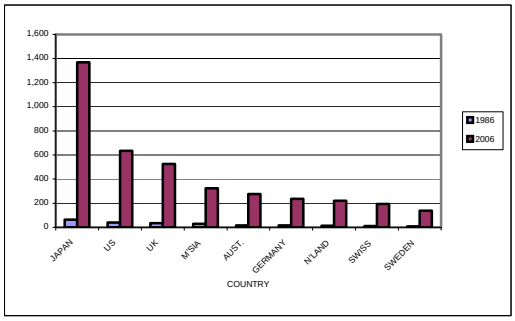
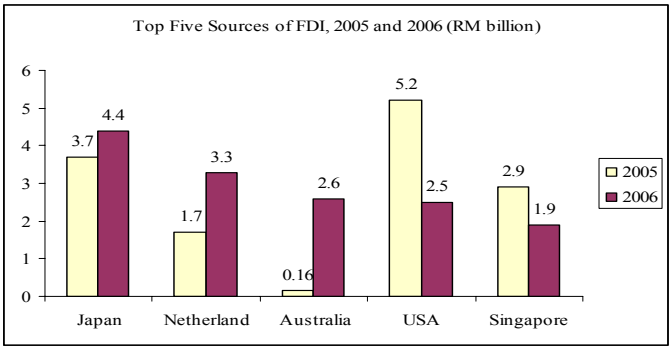


Fig. 6: Patent Applications by Country (1986 and May 2007)



It is noteworthy that the US and Japan are the top two sources of FDI in Malaysia for the past years (see Figure 7).

Fig 7: Top Five Sources of FDI, 2005 and 2006 (RM Billion)



Patent Applications by Field of Technology

In terms of division according to fields of technology in 2006, the highest number of applications comes from electrical and electronics (1,583), followed by chemical and metallurgy (1,275) and performing operations and transport (1,155). The share of patents applications from the electrical category has increased from 11% in 1993 to 23% in 2006. For the chemical category, the share of applications in 1993 is 39% but by 2006 it dropped to 19%. However, the total number of applications grew by 153% during this period. Applications from performing operations and transport constituted 13% in 1993 and 17% in 2006. The growth in applications was 583%. For the physics category, the applications grew by 572% while the share of this category in total applications increased from 12% to 15% between 1993 and 2006 (see Figure 8).

The patent application trend in the electrical and electronics sector records a positive correlation with performance of these industrial sectors in terms of sales and investment. During the period 2005-2006, sales value of the electronic and electrical sector tops other industries by recording close to RM190 billions, followed by chemicals at the value of close to RM130 billion (see Figure 9).

Fig. 8: Patent Applications by Category, 1993-2006

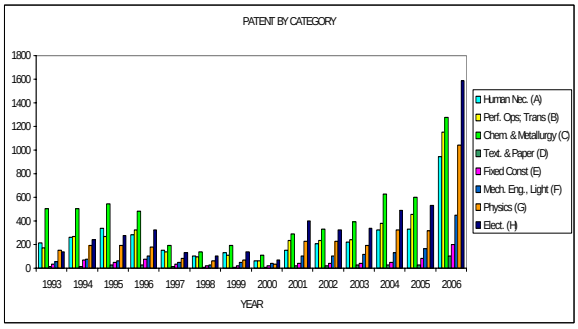


Fig. 9: Sales Values of Selected Industries, 2005 and 2006 (RM Billion)

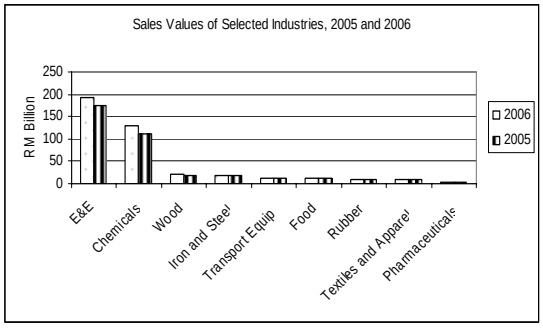


Table 1 shows that between 1996 and 2005, more than 60% of investments in the country is concentrated in five industries, i.e., electrical and electronics accounting for 31% of the foreign investment, followed by petroleum products including petrochemicals (12%), basic metal products (9%), paper, printing and publishing (7%) and chemicals and chemicals products (7%).

Table 1: Total Investments in Manufacturing Sector By Industry, 1996-2005

	Total (RM Million)	Foreign Investments (RM Million)	Domestic Investments (RM Million)	Total (%)	Foreign (%)	Domestic (%)
Total	**269699.3**	**150867.6**	**118831.7**	**100**	**55.9**	**44.1**
Electrical and Electronics products	84285.4	65466.1	18819.3	31.3	77.7	22.3
Basic Metal Products	24707.8	8473.2	16234.6	9.2	34.3	65.7
Transport Equipment	16714.7	7009.9	9704.8	6.2	41.9	58.1
Petroleum Products (Incl. Petrochemical)	31198.8	20064.1	11134.7	11.6	64.3	35.7
Paper, Printing and Publishing	19484.1	8466.5	11017.6	7.2	43.5	56.5
Chemicals and Chemical Products	17618.4	8972.7	8645.7	6.5	50.9	49.1
Non-Metallic Mineral Products	12855.8	6029.6	6826.2	4.8	46.9	53.1
Natural Gas	9521.4	1477.9	8043.5	3.5	15.5	84.5
Food Manufacturing	8969	3785.4	5183.6	3.3	42.2	57.8
Plastic Products	6314.3	2807.1	3507.2	2.3	44.5	55.5
Wood and Wood Products	6170	1676.7	4493.3	2.3	27.2	72.8
Others	31859.6	16638.4	15221.2	11.8	52.2	47.8

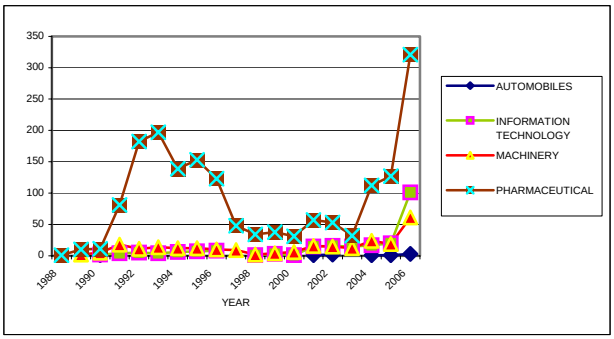
Source: IMP3 (2006), Table 1.4, p. 8

Patent by Industrial Sector

In all four sectors (ICT, machinery and equipment, automotive, and pharmaceutical and chemical industries), there can be discerned a steady growth of patent grant. However, the highest number of patent granted is to the pharmaceutical sector. The rate of growth has been phenomenal, from a mere 10 patents in 1989 to 321 in 2006. The highest total grant of patents for the pharmaceutical industry is in 1993, with a total of 197 out of 1,284 patents granted that year, which accounts for 15.3 % of total patent grant. However, there is a dip in patent grants from this sector from 1994 till 2000. This could be due to reasons which are unrelated to the reforms concerning the introduction of purpose bound product claims for medical use and the Bolar exemptions (see Figure 10).

The statistics of patent grants are consistent with the phenomenal increase in the share of domestic investment in the pharmaceutical industry. The analysis shows that the share of average domestic investment increased from 65% in the period between 1996 and 2001 to 76% between 2001 and 2005. At the same time, the percentage of foreign investment during the same period dropped from 35% to 24%. One possible conclusion that could be drawn from this is that the 1993 reform of the Patents Act 1983 to allow the patenting of 'purpose bound product claim' application has given more commercial opportunities to the industry; hence the boost in local investment.

Fig. 10: Patent Grants by Selected Industrial Sectors, 1988-2006



A sudden growth of patent grants in relation to the ICT 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. This phenomenon could be attributed to all the special measures adopted by the Government to boost the development of the ICT industry in Malaysia particularly with the establishment of the Multimedia Super Corridor and the increase in funding of R&D on ICT-related projects (see Figure 10).

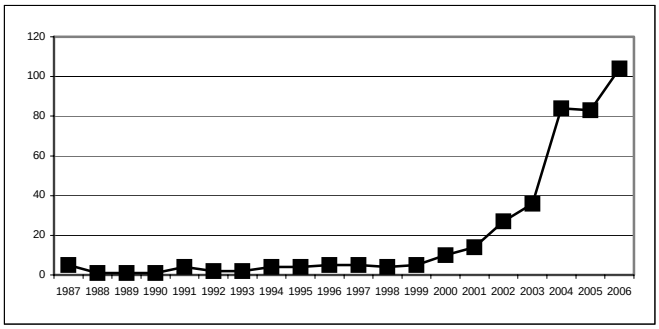
The machinery sector remains an important sector as can be seen for the number of patent grants. In the year 2006, a total of 61 patents were issued to the machinery sector which amounts to 0.9 % of the total number of patent grant. In contrast, the number of patent grants for the automotive industry is quite negligible and sporadic. The total number of such patents from 1996-May 2007 came up only to 9.

Filing Trend by Local Applicants and Patent Applications from Universities and Research Institutes

The share of local patent applications has been increasing gradually over the years. A notable increase is observed after the year 2000. The share of local patent applications increased from 2% in 1986 to 3% in 2000, before rising to 7% in 2002, and to 10% and 12% in 2004 and 2006 respectively. In the first five months of 2007, local patent applications accounted for 28% of total patent applications.

The S&T policies have contributed to the growth of patent applications from the locals, particularly from the universities. The continuous support given by the Government in financing R&D in universities through the IRPA grant has been a major factor behind the growth of patent applications among universities (see Figure 11).

Fig. 11: Patent Application Filed by Universities and Research Institutes, 1987-2006

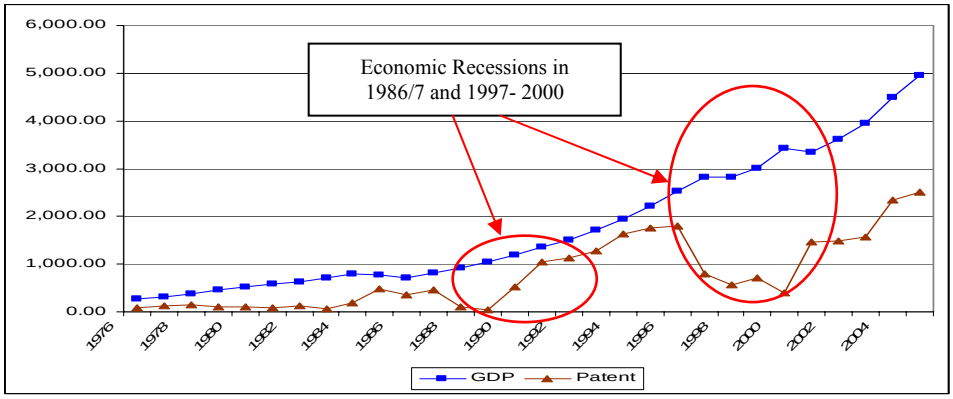


The total number of application from the universities in 2006 is 104, which accounted for about 20% of total local applications. Six of the top 15 patent applicants for the year 2006 comprise of universities; whilst 3 are statutory bodies specifically created by the Government to conduct research, development and commercialisation. This demonstrates that a significant share of R&D in Malaysia took place in universities and Government-led research institutes. This trend has to be interpreted together with the introduction of IP policies in the universities and research institutes from the mid-1990s. Under these policies, the universities allocated a major share of the potential profit to the researchers. This provides correct signal and incentives to university lecturers to delve into research and innovative activities.

IP and Economic Growth

There seems to be a clear correlation between patent applications and the country's economic performance. During the two economic recessions in the mid 1980s and 1990s, there seems to be a noticeable decrease in patent applications. This downward trend improved as the economy picked up again in 1988 and 2000 onwards respectively (see Figure 12).

Fig. 12: Nominal GDP (RM00'million) and Patent Applications, 1976-2006



5. Case Studies

A company survey was conducted from March-June 2007, using questionnaires to assess the companies' R&D strength, innovation and their experience in IP application as well as response to IP reforms. The purpose is to corroborate the findings in Chapter 4, particularly in relation to the links between IP-based reforms and IP filings. The survey instrument was followed up by personal visits and interviews to elicit responses.

The selection of the companies is made from the top companies in the industry concerned as listed in *MIDA Report on the Performance of the Manufacturing and Services Sectors 2006* (Malaysian Industrial Development Authority - the principal agency of the Ministry of International Trade and Industry for the promotion and coordination of industrial development in Malaysia). This list is then cross-checked with the list of top ten applicants given by the Malaysian Intellectual Property Office. Where possible, the final choice of companies is made based on their being big players in the relevant industries and their level of patenting activities. However, this is not always possible. One major constraint is the unwillingness of targeted companies to be involved in this survey, despite their fulfilling the desired profiles.

The study is subject to certain limitations and constraints. Though a particular sector may have many sub sectors, but the choice of sub-sector is done based on the recommendation of MIDA. Secondly, though in some sectors, companies are quite active in IP applications, however, in both the ICT and machinery sectors, it is found that the top industry players, particularly local, are not necessarily active users of the IP system. All the companies taking part in the survey are not willing to disclose data such as sales or licensing fees which are considered to be confidential. Because of this, analysis of the impact of the IP-based reforms on the company's revenue and licensing trends could not be made. Further, individual company's experience with the IP reforms could not be taken as representative of the whole industry. This section only highlights the main observations of the respondents in the four industrial sectors surveyed. Lastly, usage of IP system is not consistent in all the four industries.

Among the companies approached, a total of 9 companies from the 4 industries agreed to participate in the survey. From the ICT industry; data was obtained from one local company from the computers and peripherals and ICT software sub-sector i.e., FTEC System Sendirian Berhad and 2 local companies from the telecommunications sub sector i.e., Telekoms Malaysia Bhd and Motorola. From the machinery and equipment industry, data was obtained from Favelle Favco Berhad (FFB) and Cooper Cameron Sdn Berhad. These companies, one local and one foreign, are main players in the oil and gas sub sector. For the automotive industry data was obtained from Proton Berhad and Perodua Sdn Bhd, two major companies in the production of cars in Malaysia. For the pharmaceutical and chemical industry; data was obtained from Hovid, one of the top ten local pharmaceutical companies in Malaysia. Data was also obtained from the Malaysian Palm Oil Board which operates mainly in the chemical industry as one of the main player in the palm oil market.

For the ICT industry, the main technology comes from abroad and R&D undertaken by some of the companies is only confined to product packaging or customisation to suit the needs of the clients. Most of the local companies are assemblers. Components are sourced in the open market and thus no payment of licence fee is involved. Patents are not as relevant to them as the technology involved gets outdated fast. Moreover, customisation of products could hardly be considered as novel to be patented. Therefore, for companies like FTEC, trade marks are more important (see Table 2). Copyright, however, is quite essential. Thus copyright piracy campaigns run by the Government have in many ways indirectly benefited the ICT vendors. Trade secret law is also quite essential, particularly in the development of new software.

Table 2: Trademarks Owned by FTEC

2002	FTEC
2003	One Server
2005	Smart Eye
2006	Tech Asia

In the telecommunication industry, though there has been a substantial creation of intellectual property by companies like Telekoms, there is still a substantial reliance on foreign technology. Efforts at innovation are mostly focussed on developing technologies for usage within the company's group and are hardly licensed to outsiders. Being the main player in a robust telecommunication industry, Telekom conducts continuous R&D to maintain its lead in the industry. In terms of numbers of IP applications, the company surpasses other local companies, not only in relation to patents, but also trade marks and industrial designs (see Table 3).

Table 3: IP Applications by TELEKOMS

Year	Total No of Applications for Trade Marks	Service Marks	Industrial Design	Patents
1997	5			
1998	1	1		2
1999	2	2		1
2000	7	6		
2001	9	7		5
2002	42	28	3	1
2003	9	5	2	2
2004	58	12	9	9
2005	43	30	10	15
2006	19	7	20	19
2007	1	1	1	4
Total	196	89	45	58

For the oil and gas industry, it is found that IP protection, besides trade marks, is not that relevant. Several factors are attributed to this. First is the high entry barrier to competitors. The oil and gas industry is highly regulated. Any activities pertaining to oil drilling and manufacture of components and equipment for the industry requires licensing from PETRONAS (Petroliam Nasional Berhad, the state-owned holding company for Malaysia's oil and natural gas concerns). The design and development of cranes requires a high degree of expertise and not anybody could copy or compete.

Cranes are considered as capital expenditure. The high value of cranes results in customers favouring established companies to ensure that the cranes purchased meet safety and quality standards. The high safety standards prescribed for cranes and oil and gas drilling equipment discourage small companies from entering the market. Longer gestation period for projects favours only companies with strong financial resources. Most equipment and component, such as wharf, crane etc, are designed specifically to customer's needs, therefore patent and registered designs are relatively unimportant. The top local companies found that for these reasons patent is not relevant. Copyright and trade secrets are, however, important to secure competitiveness. Contracts with suppliers for the supply of equipment are negotiated on a confidential basis, thus heavy reliance is placed on confidentiality. Trade marks are important in relation to branding.

For the automotive industry, the companies surveyed rely substantially on basic technologies acquired through joint venture with Japanese companies which own the IP. The companies incur a substantial sum of money for royalties for the usage of the technology. The two companies surveyed conduct R&D on all cycles of innovation, including the development of new technologies such as the Proton 'campro engine'. Despite this**,** one of the company felt that patents are relatively unimportant. The company would rather keep the technology secret than reveal it through patents since the technology is continually being refined. PROTON has made several applications for patents both locally and overseas. However, it has vastly more applications in relation to trade mark and industrial designs, both in and outside the country (see Table 4).

Table 4: IP Applications by PROTON

Types of Intellectual Property	Local application	Foreign application
Patents	3 + 1	6
Trade Marks	75	1000
Industrial Designs	76	65

Trade marks are considered important as a distinguishing indicia and signs of quality. Industrial design is very important. However, both companies lament on the state of the current industrial design law which to them, is not friendly to the industry. The current industrial design law contains spare parts exceptions (must-fit and must-match) and provides that functional designs are not registrable. They also relate their problem with enforcement against counterfeited oil filters and spare parts. Because of this, the companies had to undertake extra measures to educate their vendors on the importance of IP, e.g., by embossing trade marks on spare parts. Another major complaint is with regard to the speed in which IP disputes are resolved by the courts. Litigation is frustratingly slow. Judges' unfamiliarity with the law resulted in decision not in the industry's favour. To make things worse, law reforms are very slow and not responsive to the automotive industry's needs.

For the company surveyed in the pharmaceutical industry, Hovid Berhad, the most advantageous reform is the introduction of the "Bolar" exemption. This enables the company to make applications for regulatory approvals earlier, instead of waiting for the patent to expire first. It has been active in filing patent applications in and outside

Malaysia (see Table 5). Having said that, the manner in which the Drug Approval Authority processes such applications is sometimes inconsistent with the spirit and intent of the provision. This has led to some dissatisfaction among generic drug producers.

Table 5: IP Filings by Hovid

Year	Product	Process	Areas of technology	Foreign (F) and/or local (L) filing	Foreign (F) and/or local (L) grant
1996		1	Recovery of carotenoids and tocotrienols	2 foreign / 1 local	2 foreign / 1 local
1997- 99	No IP Filings				
2000	1	1	Drug Drug delivery system	1 foreign / 1 local 20 foreign / 1 local	6 foreign / 1 local
2001					
2002	1		Hair Growth from tocotrienols	1 foreign / 1 local	1 foreign
2003		1	Extraction of phytonutrients and tocotrienols	21 foreign / 1 local	
2004-05	No IP Filings				
2006		2	Drug delivery system Extraction of natural compounds from palm oil	19 foreign / 1 local 11 foreign / 1 local	

IP ownership is a new "culture" for local companies in Malaysia. Companies that are "pioneers" in IP ownership are those corporate bodies originally set up by the Government such as Telekoms, Malaysian Palm Oil Board and Proton Berhad. As it is now, the mindset of most companies is on registration, not commercialization; with the exception of statutory bodies set up by the Government specifically to focus on R&D and commercialization such as the Malaysian Palm Oil Board. This study finds that different industry relates differently to the various IP reforms. It is thus, not possible to identify a single IP reform that would impact all the four industries surveyed.

6. Analysis of Impact of IP System on Economic Development

Co-integration test and long-run equations analyses are applied to examine the impact of intellectual property system on Malaysian economic development. Since this study aims at exploring the long-run effects of three different variables (i.e., intellectual property creation, economic growth and foreign direct investments) on IP protection, three different models are adopted.

6.1 Establishing the Economic Modelling

The first model which is adopted to investigate the long-run relationship between the IP protection and intellectual property creation is written as follows:

$$\ln(P) = \alpha + \gamma 1 * \ln R\&D + \gamma 2 * \ln GDP + \gamma 3 * \ln (IP) + \gamma 4 * \ln (K) + \varepsilon \quad (1)$$

Where,
ln P = natural logarithm of total number of patents filed
ln R&D = natural logarithm of research and development
ln GDP = natural logarithm of GDP per capita
ln IP = natural logarithm of the intellectual property index
ln K = natural logarithm of private capital

The second model used to explore the long-run relationship between IP protection and economic growth is written as follows:

$$\ln GDP = \beta_1 * \ln K + \beta_2 * \ln L + \beta_3 * \ln IP + \varepsilon \quad (2)$$

Where,
ln GDP = natural logarithm of gross domestic product
ln L = natural logarithm of labour force
ln K = natural logarithm of private capital
ln IP= natural logarithm of the intellectual property index.

Finally, the third model which aimed at examining the long-run relationship between IP protection and foreign direct investments is written as follows:

$$\ln FDI = \alpha + \delta 1 * \ln LF + \delta 2 * \ln GDP + \delta 3 * IP + \varepsilon \quad (3)$$

Where,
ln FDI = natural logarithm of foreign direct investments
ln GDP = natural logarithm of gross domestic product
ln LF = natural logarithm of labour force
ln IP = natural logarithm of IP Index

To test the long-run relationships in the Equations (1), (2) and (3), the Johansen and Juselius (1988, 1990), henceforth JJ cointegration approach, is adopted. The JJ method

of cointegration testing is based on the maximum likelihood estimation of the VAR model to determine the number of cointegrating vectors in the analysis.

Additionally, an important requirement for implementing the Johansen and Juselius cointegration test is that the variables are non-stationary integrated of the same order. Accordingly, prior to the Johansen and Juselius test, the standard Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and the KPSS unit root tests is conducted to determine the order of integration for each variables. Finally, the order of lag incorporated into the equations are selected based on the Akaike Information Criteria (AIC).

The Augmented Dickey-Fuller (ADF), Philips-Perron (PP) and KPSS tests show all the series used in this study are integrated of order one for all models (see Table 6).

Table 6: Results for Unit Root Test at First Difference for 5% level

VARIABLE	ADF		PP		KPSS*	
	Critical Value	t-value	Critical Value	t-value	Critical Value	t-value
ln P	-3.62	-4.57	-3.61	-6.73	0.17	0.20
ln R&D	-3.66	-3.56	-3.61	-3.75	0.17	0.09
ln GDP	-3.61	-3.62	-3.61	-3.51	0.15	0.09
ln IP	-3.62	-4.57	-3.61	-6.73	0.15	0.17
ln L	-3.61	-3.62	-3.55	-6.92	0.14	0.09
ln Capital	-3.24	-3.28	-3.24	-3.26	0.12	0.08
ln FDI	-3.56	-4.87	-3.55	-7.71	0.14	0.03

The JJ cointegration results presented in Table 7 show that all variables in all the models are found to be cointegrated. This means that a long run relationship exist among the variables.

Table 7: Cointegration Tests

Model:	**Null Hypothesis**	**Trace Statistics**	**5% Critical Values**
1	$r \leq 0$	168.929*	69.819
	$r \leq 1$	81.452*	47.856
	$r \leq 2$	36.453*	29.797
	$r \leq 3$	15.123	15.495
	$r \leq 4$	3.730	3.841
2	$r \leq 0$	112.411*	47.856
	$r \leq 1$	55.896*	29.797
	$r \leq 2$	27.820*	15.495
	$r \leq 3$	7.159*	3.841
3	$r \leq 0$	76.574*	47.856
	$r \leq 1$	34.610*	29.797
	$r \leq 2$	14.049*	15.495
	$r \leq 3$	5.799*	3.841

Note: * represents 5% significance level.

The results of the cointegrating equation for all the models are reported in Table 8.

Table 8: The Cointegrating Equation Results

VARIABLES	Results For Model 1	Results For Model 2	Results For Model 3
LPATENT	1.000		
LR&D	-30.703 [-15.282]		
LIP	-64.954 [-12.380]	-1.591 [-4.611]	-27.758 [-3.710]
LGDPCAPITA	92.841 [19.468]	1.000	
LCAPITAL	-31.053 [-22.473]	-0.423 [-15.130]	
LLABOUR		0.411 [1.192]	88.046 [10.478]
LFDI			1.000
LGDP			-23.362 [-9.024]
C	-151.094	-3.751	-480.403

Notes: Figures in [ ] indicates the t-statistics. Negative sign indicates a positive long-run relationship between the dependent and independent variable.

6.2 Results of Analysis

The results in Model 1 confirms that there is a long-run relationship between number of patents filed and GDP per capita, private capital, IP protection level and R&D. It is found that R&D, IP index and private investments have positive long run relationship with the number of patents filed in the country. However, the long-run relationship between patent filing and the GDP per capita appears to be negative (replacing the GDP per capita with nominal and real GDP as explanatory variable did not improve the results). This is surprising given that patent filing trend is in parallel to the trend in nominal GDP levels.

The results in Model 2 show that in the case of Malaysia, an upper-middle income country, improvement in the IP standard in the country has positively influenced the GDP growth in the long run. The results for Model 3 show that there is a long-run relationship between GDP and IP index and FDI. However, the correlation between labour force and FDI inflows appears to be negative. This could be explained by graduation of the economy to less labour intensive industrial activities.

7. Discussion and Proposals

This study has identified the three major reforms that have impact on IP creation and economic development. From a comparison of the legal reforms and the trends in IP application, one could conclude that for some legal reforms, a direct correlation could be seen between the reforms and IP filings. In the area of patents, several reforms have contributed to the growth of IP filings. These are the Malaysia's accession to the Paris Convention, introduction of the modified examination system and improved processing of patent applications.

Filing trends based on nationality also correspond with the amount of FDI. From the breakdown of the total number of patent applications according to country of origin from 1986 - 2006, Japan ranks first whilst the US ranks second. This is consistent with the pattern of FDI inflows. Japan and the US are the top three foreign investors in Malaysia for the past decade.

In terms of field of technology, the filing trends also correspond with the amount of sales and investment in a particular industry. The emphasis on the electrical and electronics sector in the industrial policy could have been the key factor in the substantial growth of patent applications from the electrical category. This could be attributed to the establishment of the Multimedia Super Corridor project in 1996 and extra funding pumped in by the Government to spearhead the ICT projects.

In relation to the four industrial sectors that have been identified for the case studies, i.e., ICT, machinery and equipment, automotive, and pharmaceutical and chemical industries, there can be discerned a steady growth of patent grant. However, the highest number of patent granted is to the pharmaceutical sector. The rate of growth has been phenomenal, from a mere 10 patents in 1989 to 321 in 2006.

The S&T policies have also contributed to the growth of patent applications from the locals. Under the S&T policy, emphasis was placed on accelerating R&D, and the amount of money disbursed for R&D has been steadily increased. The continuous support given by the Government in financing R&D in universities, through the IRPA grant, has been a major factor behind the increasing growth of patent applications among universities from the year 2000 onwards. Patents filed by universities and research institutes increased significantly from an average of 4% of the total patent applications between 1987 and 2000, to an average of 10% between 2001 and 2006.

Fiscal measures introduced by the Government in the 1990s have also contributed to a sharp increase in local patent applications. Incentives given to companies such as pioneer status, tax and tariff exemptions, tariff protection and preferential loans assist companies to be competitive. This provides confidence in the companies to adopt long term strategies such as involvement in R&D and eventually in filing for IP applications. Between 2001 and 2006, the percentage of local applications amounts to 10% of total applications, and in the first five months of 2007, the percentage rose to 28%.

Another contributing factor to the number of patents filed in Malaysia is the economic

performance of the country. There seems to be a clear correlation between patent applications and the country's economic performance. During the two economic recessions in the mid 1980s and 1990s, there seems to be a noticeable decrease in patent applications. This downward trend improved as the economy picked up again after 1988 and 2000 respectively. This is further corroborated by the regression analysis where it is found that there is a positive correlation between the number of patent filings and economic growth. This is due to the fact that the more prosperous the economy is, the higher the investment is expended in R&D.

It is also found that there is a high level of foreign patent filing in sectors where FDI is the highest, for example, in the electrical and electronic sub sector. Similarly, the strengthening of IP protection as reflected in the increase in the IP Index has positive influence on patent filings.

Concerning the impact of IPRs on FDI, the results show that there is a positive correlation between FDI inflows and the IP index. This implies that a stronger IP protection attracts more FDI inflows. This is consistent with our earlier findings in Chapter Four relating to the pharmaceutical industry where we found that the favourable environment created by the various legal reforms has boosted the amount of investment in the industry.

Proposals

1.0 To sustain the upward trend in R&D and patenting activities, the present S&T policies should be further augmented to reach a higher target so that the process of catching up from technology-user to technology-producer will be accelerated.

2.0 In this connection, the present IP awareness campaign conducted by the Government should be maintained and intensified.

3.0 The university IP policies, with their reward systems, seem to be instrumental in stimulating the growth of IP creation in universities. Steps should be taken to ensure that such policies are effectively implemented.

4.0 Incentive to encourage companies to register their inventions by providing tax exemption for expenses incurred in IP filing and maintenance should be given.

5.0 Company should be exposed to the concept and methodology of IP auditing to be in a better position to appreciate the true status and value of their IP which may be lying unrecognised and unutilised to enable them to tap any potential value therein.

6.0 The current standard of IP protection and its administration be maintained and constantly updated to keep in line with international norms to retain and stimulate further inflow of FDI into countries, particularly to the high-tech industries.

7.0 To overcome the lack of commercialisation, a Technology Transfer Advisory Service (TTAS) under the auspices of the Ministry of Science, Technology and

Innovation could be set up to assist in matching the industry's needs with the innovative products produced by the various research institutions to ensure optimum commercialisation.

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