Hong Kong Innovation Project

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Enhancing HKSAR's innovation system:

Is there a role for public policy?

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1. Introduction

This paper seeks to complement the various sector-specific papers in this project by examining the possible role of public policy on intellectual property (IP) in enhancing Hong Kong SAR (HKSAR)'s innovation system. While there are various interpretations of the scope of IP policy in the literature (see e.g. Idris, 2003, UNIDO, 2006, JSCIP, 2002) , in this paper we take a broad interpretation that covers not only policies to protect and enforce IP rights, but also policies to promote the creation of IP and facilitate their commercial exploitation and market transactions. In addition, besides examining the efficacy of the enacted policy framework, we also look into the effectiveness of institutions in policy implementation and enforcement.

Prior work on Hong Kong's economic competitiveness has offered contrasting views on the possible role of IP policy in Hong Kong. On the one hand, authors like Enwright et. al. (1997) have argued for a minimalist state role. They pointed out that a major pillar of Hong Kong's past phenomenal success is its legal system characterized by the strict rule of law and judicial independence. However, in contrast to other developmental states in East Asia like Japan, Korea, Singapore and China, they argued that the unique strength of Hong Kong's economic system has been its lassie faire approach, popularly described as "positive non-intervention", whereby the government provides the necessary legal framework to facilitate free trade and efficient market transactions, but otherwise does not intervene in favor of any particular industry, nor does it directly engage in economic activities through state-owned or state-controlled enterprises. In this minimalist state perspective, the government of Hong Kong should continue its strong focus on protecting property rights in general, and intellectual property rights in particular. However, there should be little role of the state in

promoting IP creation and commercialization, relying instead on market forces to determine the level of IP creation and usage.

In contrast, Berger and Lester (1997), in their work on "Made by Hong Kong", have highlighted the need for the state to play a stronger role with respect to IP. Besides pointing out that, as of the mid-1990s, Hong Kong's record of enforcement of IP rights has been patchy, they made a strong case for the government to take a more pro-active role in promoting a culture of IP creation among the local industries. It is interesting to note that, while Enwright et. al. (1997) does not contain any entry on Intellectual Property in its index, Berger and Lester (1997) makes numerous references to IP in its index.

In this paper, I re-visit the above debate by first examining the salient developments of both aspects of IP policy – IP protection and IP creation/commercialization promotion – in HKSAR in the period after the end of British colonial rule in 1997. I then examine international comparative evidence on HKSAR's IPR protection regimes vs. selected reference countries over the years, as well as to provide a comparative analysis of the pattern and trend of patenting in HKSAR over the last 2 decades versus Singapore, a developmental state that has adopted a more interventionist policy approach towards IP. Based on the above comparative analysis, I offer a number of recommendations on the role of IP policy in the future development of HKSAR's innovation system.

2. Development of IPR Protection Policies in HKSAR

By international standards, HKSAR has a relatively well-developed legal framework for protecting intellectual property rights (IPR). Hong Kong's mini-constitution – the Basic Law – specifically provided in Articles 139 and 140 that HKSAR should on its own develop appropriate policies and afford legal protection of IPR. An IP Department (IPD) was established in July 1990 with three stated objectives: (a) to advise the Secretary of Commerce, Industry and Technology on policies and legislation to protect IP in the HK SAR; (b) to operate HKSAR's trade marks, patents, registered designs and copyright licensing bodies registries; and (c) to promote IP protection through public education (IP Department, 2004).

With the return of Hong Kong to China and its formal designation as HKSAR in 1997, the various IP-related legislations prevailing in Hong Kong were updated. The new Patents Ordinance, Copyright Ordinance and Registered Design Ordinance came into effect in June 1997, while a revised Trade Marks Ordinance (Cap 559) was introduced in April 2003. As part of China, HKSAR has also been covered by all the major international IP conventions, including the Paris Convention, the Berne Convention, the Universal Copyright Convention, and the Patent Cooperation Treaty (PCT). HKSAR also became a member of WTO in its own right, and signed the WTO TRIPS Agreement.

Notwithstanding the introduction of its own IP legislation, it should be noted that HKSAR post-1997 continues to operate a patent system based on "re-registration" of patents registered elsewhere, rather than having its own system of patentability examination. During the colonial times, patent protection was provided in Hong Kong by

re-registering a patent filed with the UK patent office, and the protection lasted as long as the original patent in UK. Although this registration system was later extended to cover patent filed with European Patent Office (EPO) and the PRC State Intellectual Property Office (SIPO) under the new IP legislation, HKSAR has as yet introduced its own examination system. HKSAR's IPD did introduce a short-term patent ("petty patent") system of its own that provides protection of shorter duration (maximum of 8 years vs. 20 years for standard patents) for inventions with limited novelty that may otherwise not qualify for full patent protection, and for which prior-registration elsewhere is not required. However, the examination system set up by IPD for such short-term patents is rather limited in scope, and mainly entails submission of a search report by the UK Patent Office, EPO and SIPO or a PCT-recognized international searching authority.

Besides having a relatively updated and comprehensive IP legislative framework since 1997, data from the IP Department also suggest that HKSAR has made significant progress in terms of actual enforcement of IPR protection. As late as 1997, Hong Kong was still placed on the 301 Watch List of the US Trade Representative. However, with the enactment of the Prevention of Copyright Piracy Ordinance and amendments to the Import and Export Ordinance in 1997, the Customs and Excise Department (CED) had set up a special task force to implement more rigorous enforcement actions, resulting in drastic drop in the reported incidence of copyright piracy, particularly pirated optical discs. By 1999, HKSAR was removed from the 301 Watch List (www.ipd.gov.hk/eng). More recently, HKSAR had also stepped up enforcement of trademark violation cases (Lam, 2006).

The IPD had also embarked on a series of public educational campaigns in recent years to raise awareness of IP and IPR protection. Consequently, the department was able to report a survey it conducted in 2003 that over 90% of HKSAR residents agreed that IPR protection is necessary; this has further increased to 96.3% in its latest survey in 2008. In addition, the IP Department also made substantial efforts to streamline the administrative processing of IP applications and registration, including the provision of electronic searching, filing, payment and publication services for patents, copyrights and designs since 2003. In 2006, new interactive services were launched that significantly improved the response time for various IP administrative processes such as change of particulars of IP owners.

The improvement in the IPR protection regime of HKSAR since 1997, as reported by the IP Department, is borne out by a number of international comparative studies that provided indices for measuring IPR protection across countries, including the *Economic Freedom of the World Annual Report* and the annual *Global Competitiveness Report* (GCR). As can be seen from Table 1 below, HKSAR's overall patent rights index rose only slightly from 2.46 in the late 1970s to 2.57 in 1995, but increased at a higher rate to 2.90 in 2000.

Notwithstanding the progress made, HKSAR's overall patent rights index in 2000 remained significantly below those of Japan and Korea, which had achieved among the highest level of patenting outputs in Asia, as well as Singapore and Ireland, which had registered significant growth in patenting since the mid-1990s.

Table 1 Patent Rights Index, *Economic Freedom of the World Report*

	1960-75	1975-80	1995	2000
Hong Kong	2.04	2.46	2.57	2.90
China	n.a.	n.a.	1.55	2.48
India	1.68	1.57	1.51	2.18
Japan	3.24	3.94	3.94	4.19
Korea	2.87	3.61	4.20	4.20
Singapore	2.37	2.57	3.90	4.05
US	3.86	4.41	4.86	5.00
Switzerland	2.84	3.80	3.91	4.05
Ireland	2.69	2.99	3.32	4.00

Source: 1960-75, 75-90 -- W. G. Park, "Intellectual Property & Patent Regimes", *Economic Freedom of the World: 2001 Annual Report*, Chapter 4; 2000 -- W.G. Park & S. Wagh, "Index of patent rights", *Economic Freedom of the World: 2002 Annual Report*, Chapter 2

Note: The index is based on five categories: (1) coverage (the subject matter that can be patented); (2) duration (the length of protection); (3) enforcement (the mechanisms for enforcing patent rights); (4) membership in international patent treaties; and (5) restrictions or limitations on the use of patent rights.

More recent comparisons are unfortunately not available, as the *Economic Freedom of the World Report* has switched to adopting the IPR protection index provided by the GCR after 2000. Unlike the Patent Rights Index, GCR's IPR protection index covers all aspects of IP, not just patent, and is derived from survey of business executives using a Likert scale. As Table 2 below shows, HKSAR appears to score relatively higher based on this broader index, ranking it higher than Korea and Taiwan. However, it remains below the level achieved by Japan, Singapore and Ireland. Moreover, while the index for HKSAR has stayed flat between 2003 and 2008, those of Japan, Korea, Singapore and Ireland had continued to improve.

The overall evidence thus appears to suggest that HKSAR has seen improvement in its IPR protection legal framework and enforcement institution since 1997, but that it remains below a number of other economies that either had a longer history of promoting

IP (particularly Japan and Switzerland) or that had emphasized the adoption of business-friendly policies to attract international inward DFI (Singapore and Ireland).

Table 2 GCR IP Rights Protection Index, 2000-2008, selected years

	2000 (out of 10)	2003 (out of 7)	2008 (out of 7)
HK	6.3 (4.4)	5.3	5.4
China	3.22 (2.3)	3.4	3.9
India	3.27 (2.3)	3.5	3.7
Japan	7.55 (5.3)	4.7	5.7
Korea	5 (3.5)	4.5	5.0
Singapore	7.62 (5.3)	5.9	6.3
Taiwan	n.a.	5.0	4.9
US	9.1 (6.4)	6.2	5.6
Switzerland	9.17 (6.4)	5.9	6.3
Ireland	7 (4.9)	4.7	5.6

Note: In 2000, the Likert scale is 1 to 10. Figures in bracket are re-scaled to the 1 to 7 range.
In 2004, the index is measured by responses to the following question: Intellectual property protection in your country (1 = is weak and non-existent, 7 = is equal to the world's most stringent).
The index in 2008 is measured by responses to the following question: Intellectual property protection and anti-counterfeiting measures in your country are (1 = weak and not enforced, 7 = strong and enforced).
Source: Global Competitiveness Report, various years

3. Development of IP Creation & Commercialization Policies in HKSAR

Besides ensuring the protection and enforcement of IPR, another major IP-related public policy thrust pertains to the promotion of IP creation and its commercial exploitation. While a major driver for IP creation is the level and intensity of involvement of public research institutions, enterprises and individuals in R&D and other creative activities, experience in other newly industrialized economies suggests that there may be an additional role by the state to explicitly promote the translation of R&D efforts into tangible intellectual property, over and above the policies to promote R&D and

innovation activities themselves (see e.g. JSCIP (2002)). For example, patenting output of Taiwan's Industrial Technology Research Institute (ITRI) rose substantially from the mid-1980s, after a change in the strategic direction of the institute leadership to emphasize patenting output as a performance indicator (private communication, C.C. Lin, ex-president of ITRI).

IP-creation promotional policies can take various forms, e.g. through the use of financial subsidies to offset the cost of applying for IP protection, or the use of IP creation and their subsequent commercial exploitation as performance indicators (e.g. licensing income) to incentivize public research institutions to create and commercialize IP. High-prestige public recognition of IP success in the form of national awards may similarly incentivize private enterprises and individuals to focus efforts on IP creation and commercialization *outputs*, over and above the award of *input* resources to promote R&D activities such as public R&D grants and innovation subsidies.

Besides supply-side policy, public policies can also promote the commercial exploitation of IP by stimulating market demand and improving the efficiency of the market transaction process. Market demand can be boosted by financial incentives for enterprises, particularly SMEs, to adopt new technology through in-licensing of IP. Finally, to the extent that the market for IP transactions is imperfect, there may be a role for government intervention to facilitate the development of the IP transaction markets through various means, e.g. stimulating the development of the intermediary IP professional services industry, subsidizing the training of IP professionals, facilitating the formation of IP-related industry associations, and providing public funding for infrastructure that facilitates IP transactions (e.g. online IP database and IP market exchange). These public policies should be understood as temporary in nature, to fill a

temporary gap in market development, or to jumpstart/speed up the intermediary industry development process itself.

Because the creation and exploitation of IP is intimately linked to the innovation process in any innovation system, it is obviously difficult to completely isolate policies designed to stimulate IP creation and commercialization from general policies to promote R&D and innovation activities. Indeed, even the IPR protection policies described earlier are ultimately meant to have a direct incentivizing impact on IP creation and commercialization. It is also likely that some of the IP promotion policies are implemented by the very same organizations in charge of general promotion of R&D and innovation activities. Nevertheless, by examining the various public institutions involved in R&D and innovation promotion, one can get a sense of the extent to which these institutions and their programs have explicitly incorporated policy elements aimed at stimulating IP creation and commercialization. In addition, by examining the state of development of the IP professional services industry, one can gauge the maturity of the market for IP commercialization, and hence the potential need for public intervention.

a) Strategic IP policy directions by the Innovation and Technology Commission (ITC)

Any assessment of HKSAR's public intervention in innovation promotion must start with the Innovation and Technology Commission (ITC), which was established in July, 2000 with the explicit mission to spearhead HKSAR's drive to become a world-class, knowledge-based economy. To achieve its mission, ITC primarily functions as a funding agency that promotes specific innovation activities through various specific funding schemes (ITF, ARF and DesignSmart), and as a developer of various

infrastructural facilities and institutions (HKSTPC, ASTRI, HKPC, HKDC, etc.). As the specific goals and scope of functions of these ITC-funded schemes and institutions have already been analyzed elsewhere in this project, I will focus instead on examining the possible roles that ITC is playing to promote IP creation and exploitation through these funding schemes and institutions.

Based on my reading of various ITC documents and interview with selected senior officials at ITC, my impression is that, while ITC's overall objectives implicitly cover the promotion of IP creation as part of its mission of promoting innovation, it does not appear to have a high-level, explicit policy targeted at increasing IP output per se, beyond stimulating R&D and innovative activities in general. ITC does provide a patent application grant that subsidizes the cost of patent application by HKSAR residents, but the reach and impact of this grant scheme appears to be modest.

ASTRI had been given the autonomy to experiment with alternative mechanisms for IP commercialization, including spin-offs in the early years, and a focus on IP licensing in recent years. Discussion with senior management of ASTRI suggests that the criteria for measuring the performance of ASTRI had been evolving, and there has been no direct, long-term strategic top-down policy imposed by ITC. Thus, while ASTRI management has paid greater attention to licensing income generation in recent years, this is only in response to perceived future ITC funding constraints, not a direct IP creation policy imposed by ITC.

ITC imposes an explicit IP policy through its funding in the granting of the University-Industry Collaboration Programme (UICP) funding to private enterprises that wish to leverage the expertise of Hong Kong universities in their R&D activities. Provided that the companies are contributing at least 50% of the R&D costs, with UICP

grant providing the balance, all IPR generated from these R&D projects will accrue to the companies. While it is intended to incentivise private industry to tap university expertise, the strong IP rights that it grants to private industry may discourage university faculty with cutting edge research capabilities to engage in such activities.

b) IP policy in the Public University sector

Besides the ITC, the public university sector plays a significant role in the innovation system of HKSAR. As highlighted by David Mowery in his paper on university-industry collaboration and technology transfer in HKSAR for this project, the five major public universities in HKSAR, despite being funded in similar ways by the government, pursue quite diverse approaches to technology commercialization in general and IP management in particular. Moreover, their strategies have changed during the last 20 years, with some cutting back on direct involvement in technology commercialization promotional activities, while others expanding the scope of involvement through e.g. the establishment of venture capital fund. In their study of HKUST, Sharif and Baark(2008) further described the significant changes in IP policy of the university over time, moving from focusing on spin-offs in the 1999-2001 dot-com boom period to a greater emphasis on licensing from 2003 onwards. Leung(2008) also highlighted the diverse performance of the eight public universities in terms of spin-offs that exploit IP generated by university research.

The relative autonomy of the individual universities to pursue their own technology transfer and IP management strategies reflects the lack of strategic top-down direction from the HKSAR government. As highlighted by Mowery (this volume), this lack of strategic policy direction by the Hong Kong government extends beyond the link

between universities and industry in HKSAR itself, to links between the universities in Hong Kong with innovation activities in PRC China by universities and industry there.

c) Development of IP professional services industry

While government in a number of newly industrialized economies, notably Singapore and Ireland, have actively been promoting the development of various IP professional services in their economy, a similar focus appears to be lacking in HKSAR. To begin with, the ITC does not seem to regard as part of its mission to promote the development of IP-services industry, neither does it see itself playing a role in promoting the training and development of IP professionals.

Likewise, the IP Department (IPD) appears to be primarily focused on promoting awareness of IP rights and on formulating and implementing policies to effectively enforce the protection of IP rights. As highlighted earlier, while IPD appears to have done a commendable job in terms of conducting regular mass media publicity campaigns, keeping abreast of and updated on latest IP protection legislations worldwide, making the process of registering and examining IP applications efficient, and carrying out high visibility enforcement exercises, IPD does not seem to have a mandate on promoting the development of the IP professional services industry as a means to stimulate IP commercializaton.

HKSAR does have a government agency charged with promoting investment called Invest Hong Kong. However, discussion with senior officials at Invest HK suggests that, while Invest HK's overall mandate is to make HK a desirable place for local and foreign businesses to invest and operate in HK, its primary policy tool is to keep taxes low and public infrastructure efficient, and to provide a transparent legal and business-friendly environment. As such, Invest HK does not pursue any industrial policy

in the sense of providing special incentives to particular industries. The development of the IP professional services industry is seen to be best left to market forces, and not for the government to promote.

There is no reliable statistics on the size and sophistication of the IP professional services industry in HKSAR. A 2004 study by Jinan University, commissioned by IPD, estimated that the number of certified attorneys engaging mainly in IP-related practices in HKSAR to be around 100, based on membership in the HK Institute of Trade Mark Practitioners and the Hong Kong chapter of APPAA (Asia-Pacific Patent Attorney Association) (Jinan University, 2004). However, the same study highlighted that work related to trade marks form the largest category of services provided, with patenting of lower significance. Moreover, my interview with the senior partners of a couple of leading private law firms with significant IP practices, who are executive committee members of the Hong Kong chapter of APPAA, suggested that the actual number of law firms with significant IP practice (more than one full time lawyer equivalent) is small, probably less than 10. They also highlighted a concern that there is no requirement for certification or qualification of trade-mark agents in Hong Kong, and as a result, quality & professional standards have been rather uneven. Lobbying by the APPAA for such certification had been rejected by IPD, out of concern that this represents restriction of market access by the larger law firms. In addition, the interviews suggest that much of the patenting work in HKSAR itself is of an agency nature, with the substantive patent drafting and prosecution strategy work actually contracted to patent specialists in the US or UK. Confirming the finding of the Jinan study, IP litigation and IP strategic consulting work were also cited to be of lesser importance.

The Jinan study also found that the HKSAR IP professional services firms tend to serve largely customers in HKSAR itself, with relatively little reach to customers in Mainland China and the Pearl River Delta regional hinterland. Despite the signing of the Closer Economic Partnership Agreement (CEPA) between Mainland China and HKSAR, only one quarter of the IP professional services firms in HKSAR surveyed by Jinan University reported any intention to expand operation to Mainland China in the foreseeable future. The survey also found only a small proportion of clients of IP professional services in Guangdong Province actually engaged the services of HKSAR-based firms. My interviews with several IP professional services firms in Beijing and Shanghai similarly suggest that few clients in these two cities use the services of HKSAR-based firms.

It is not clear whether the lack of a local patent examination system in HKSAR may have hindered the development of its IP professional services industry, although the experience of other jurisdictions that experienced rapid growth in the IP professional services industry, including Taiwan and China, seem to suggest that this could have been the case. Arguably, the establishment of a local examination system (versus the current registration system) would raise demand for local IP expertise, and as evidence from other countries would suggest, the IP examination system has often been a training ground for the manpower that staff the private IP professional services industry. A local examination system would also lead to development of specialization in the court system to handle IP litigations cases and to establish its own case laws over time.

It is also unclear whether HKSAR's adoption of an alternative short-term patent system has facilitated or hindered the development of its IP professional services industry. While more than 20 countries around the world have implemented some form of "petty

patent" system to provide protection innovation that has a lower standard of inventiveness, the experience has been mixed. In HKSAR, this has been primarily used to protect toys and electronic goods. Due to their limited inventiveness requirements, they are more likely to have spurred the growth of design services (see below) rather than advanced IP expertise.

d) Policy to facilitate IP exploitation by local SMEs

In many countries, a major focus of public innovation policy concerns the lack of capacity by local SMEs to exploit IP created by public research institutes, universities or other private enterprises. Besides the lack of technical knowledge and financial resources, many local SMEs are also not familiar with the process of technology transfer and the complexities of IP licensing. Policies to facilitate IP exploitation by local SMEs can take various forms, e.g. directing public research institutes to license their IP cheaply to local SMEs, or giving subsidy to the local SMEs to reduce their cost of licensing external technologies to improve their business. .

In the case of HKSAR, the ITC directly funds a number of public applied R&D centres to conduct applied R&D and provide technical assistance to local SMEs in a number of manufacturing industries (textile and clothing, logistic and supply chain enabling technologies, automotive parts & accessory systems, etc.), but the emphasis appears to be on fostering joint R&D and technical support rather than developing IP portfolios to be licensed to local enterprises cheaply. ASTRI does appear to have a strong focus on developing a portfolio of IP for licensing, particularly in semiconductor chip design technology (see chapter by Fuller, this volume). However, there appears to be a mismatch with the needs of local SMEs in HKSAR, as many of the enterprises that are keen to license ASTRI's technologies appear to be based in China.

There appears to be no program that provides subsidy to the local SMEs themselves to encourage them to adopt new innovation (through in-licensing of new technologies), although ITC does run a New Technology Training program that provides subsidies for training of manpower to learn new technical skills. .

e) Development of Industrial Design Capability

According to registration statistics by IPD, industrial design represents a significant form of IP creation in Hong Kong. My interview with a number of indigenous design firms and a former manager at the HK Design Centre indicate some governmental efforts in promoting the design industry. However, a major criticism was raised that the primary focus had been on physical infrastructure (a building to house design firms), with inadequate effort paid to the development of indigenous design skills and the nurturing of design business and IP management capabilities among local design firms. There was also criticism that local university industrial design courses did not appear to include sufficient exposure to the business and IP aspects of industrial design.

f) Development of Early-stage Venture Capital and Angel Investment Groups

Besides the IP professional services firms, a related industry that has been found to be critical in supporting technology commercialization through start-ups is that of venture capital firms and angel investors who have the technology and IP-savvy to invest in early stage IP-based high tech start-ups (see e.g. Wright et. al., 2006). Interviews with the Hong Kong Venture Capital Association suggest that the venture capital industry in HKSAR is primarily dominated by late-stage VC firms and private equity funds, with very little early-stage VC funding available. Moreover, while individual angel investors do exist who invest in early-stage start-ups, there appears to be no formal business angel

networking groups or associations (like the Band of Angels in Silicon Valley) that organize regular networking activities to match-make start-ups with investors.

The Cyberport project was originally conceived as a platform for incubating start-ups in ICT. However, in the aftermath of the dotcom crash in early 2000, the project appeared to have evolved into a primarily physical infrastructure project, with relatively little emphasis on additional value-adding activities to enhance IP-commercialization capability. There was some effort to involve mentoring by senior industry players, and to provide networking with potential angel investors, but the scale of the efforts appear to be quite modest. Moreover, its distance from the public universities is a deterrent to dense interactions with university students and researchers.

In summary, in contrast to formulation and implementation of IPR protection policies, which have received high level attention, with considerable new legislative updates and institutional enforcement efforts to stay abreast with international developments, public policies to intervene directly in promoting IP creation and commercialization appear to be lacking strategic direction from the top, and are generally implemented in a more diffused, ad hoc manner. There appears in particular a lack of strategic policy focus on promoting HKSAR's IP professional services industry.

4. IP Creation Pattern and Trends in HKSAR vs. Singapore since 1997

To what extent has the apparent lack of strategic focus on IP policy by the Hong Kong government affected the pace of IP creation and commercialization in HKSAR since 1997? While there are many factors that influence the rate of IP creation and exploitation, it would nonetheless be useful to examine the actual pattern and trend of IP

creation in HKSAR over time, as benchmarked against Singapore, which has arguably adopted a more interventionist approach to promoting IP creation. For this comparative analysis, we will focus primarily on patenting rather than all classes of IP, given the closer link of patents to technological innovation activities. We use in particular data on utility patents granted by the USPTO as the basis for comparison, due to the lack of comparability of national-level patenting records that may reflect differences in ease of obtaining patent protection, but also because the commercial importance of the US market provides a better gauge of the commercial potential of the patents (Jaffe and Trajtenberg, 2002).

We believe that such a comparative analysis is more instructive than looking at patenting output trends in HKSAR alone, given that IP creation tends to increase over time in virtually any growing economy. While both HKSAR and Singapore have developed relatively efficient system for IPR protection, the aim of the comparative analysis is to discern if the rate of growth in IP creation is higher in Singapore with its more interventionist role in promoting IP creation.

Annex Tables 1-9 and Annex Figure 1-2 provide more detailed information on the trends and patterns of patenting in HKSAR vs. Singapore. Collectively, they portray considerable differences in the trend and pattern of patenting in the two economies over the last three decades. We highlight in particular the following salient differences:

i) While HKSAR and Singapore have both experienced rapid growth in US patenting, Singapore's growth rate has been faster since the mid-1980s (Annex Table 1)

ii) The difference became even more marked when we exclude design patents and only examine utility patents (Annex Table 2)

iii) Since the early 2000s, Singapore has overtaken HKSAR in terms of number of US utility patents; on a per capita basis, the differences in invention patenting intensity of Singapore and HKSAR is even more marked (Annex Table 3 and Annex Figure 1). Even if we adjust for the lower R&D expenditure per capita in Hong Kong vs. Singapore, Singapore remains ahead in recent years

iv) In terms of Trademark registration, while HKSAR continued to have a higher number of trademark registration than Singapore, the latter had experienced a higher overall growth rate (Annex Table 4)

v) HKSAR's patenting is characterized by a rather high proportion of design patents, compared with not only Singapore, but other countries like Japan, Korea and the US (Annex Table 5)

vi) A larger proportion (72%) of HKSAR's patents are owned by local assignees than is the case of Singapore, where half of the patent inventions are owned by foreign entities, primarily foreign MNCs with R&D operations in Singapore (Annex Table 6). It is no surprise that the 20 largest patent owning organizations in Singapore are dominated by foreign firms (Annex Table 9b), whereas in HKSAR, local organizations had a bigger presence than foreign firms (Annex Table 9a).

vii) HKSAR's patenting is also characterized by a relatively higher proportion of ownership by individuals vs. organizational assignees, compared not only with Singapore (Annex Table 6), but also other countries like Japan, Korea and USA

viii) Universities in HKSAR appear to contribute a smaller share of US patenting than universities in Singapore in their respective economies (2.7% vs. 4.4%). Likewise, the share of patenting by public research institutes in HKSAR is negligible, but constituted 5.5% of total patenting output in Singapore (Annex Table 6)

ix) Using forward citations as a proxy measure of patent quality, HKSAR's patents are found to be of lower quality than those of Singapore since the mid-1980s. This finding is true whether we use the average forward citations per patent as the quality indicator (Annex Table 7a), the relative citation index (Annex Table 7b) or the share of high impact patents (Annex Table 7c)

x) While electrical and electronics technologies have become the largest technology field for patenting in both HKSAR and Singapore since the mid-1980s, the specialization in this field have become more marked in Singapore (close to 50% in the last 10 years). Moreover, computers and communication technologies have also become relatively more important in Singapore than in HKSAR in recent years (Annex Figure 2). As a result, the degree of concentration by technological fields had increased in Singapore over the last 10 years, while that in HKSAR had declined (Annex Table 8).

Overall, the statistical evidence from US patenting seems to suggest that HKSAR has lagged behind Singapore in recent years in terms of both the quantity and quality of utility patent creation. While HKSAR continued to lead in design patent and trademark registration, Singapore is registering higher trademark growth rate. Singapore's higher degree of technology specialization, and its higher contribution of public research

institutes and universities in patenting output, are reflective of the higher public sector role in the national innovation system of Singapore vs. HKSAR, both in terms of relative share of innovation activities conducted by the public universities and public research institutes, as well as deliberate DFI policy to attract foreign MNCs to conduct R&D in targeted technology fields in Singapore.

The above profile of patenting outputs in HKSAR and Singapore is also consistent with findings on the pattern of R&D and innovation activities as revealed by R&D surveys in both economies. Based on the 2007 survey of innovation activities in the business sector in Hong Kong (Census and Statistics Department, HKSAR, 2008), the largest contributor (45%) of in-house R&D expenditure in HKSAR is the commerce and trades sector, followed by finance and business services (36%), with the manufacturing sector contributing less than 10%. In contrast, according to the 2006 R&D survey of Singapore, manufacturing accounted for 67% of private industry R&D. While small and medium enterprises accounted for more than half of all business R&D expenditure in HKSAR, large manufacturing enterprises, primarily foreign MNCs, contributed over two-thirds of private sector R&D spending in Singapore.

Similar findings can be derived using utility patenting data from the European Patent Office (EPO). For example, in the period between 1976 and 1997, Hong Kong had more EPO utility patents than Singapore (133 vs. 112), but in the subsequent decade (1998-2007), HKSAR's EPO utility patent counts had fallen to only one-third that of Singapore (182 vs. 529).

While it is difficult to ascertain the extent to which the observed differences in IP creation rate can be attributed to the more pro-active role of the state in Singapore in promoting IP creation vs. Hong Kong, it seems plausible that this has been a contributing

factor, especially given that the rapid ramp-up of IP creation outputs in Singapore since the late-1990s coincided with the establishment of a number of public initiatives targeted specifically at strengthening IP creation and commercialization capabilities. In particular, we can highlight the following recent developments in Singapore that may be relevant:

- The centralization of IP management and commercialization policy among all the public research institutes managed by the Agency for Science, Technology & Research (A*STAR) under one organization, Exploit Technologies (ETPL).

- The establishment of an IP Academy in 2003 to provide executive IP education and to develop thought leadership on IP management in Singapore and Asia

- The establishment of the IP Office of Singapore (IPOS) in 2001 with a broad mission to not only administer IP laws and to promote IP awareness (as covered by IPD in HKSAR), but also to provide infrastructure support for IP development, including working with the IP business and professional community to identify and develop business opportunities related to IP, especially in terms of making Singapore a regional hub for IP management services and thought leadership (e.g. the convening of the annual Global Forum on IP in 2008). Unlike HKSAR, IPOS implements a local patent examination system, although registration of patent applications submitted to other PCT member jurisdiction is also allowed.

- The active strategic role of the Economic Development Board (EDB) in Singapore (which is the counterpart of Invest HK) to attract investment and talents to the IP professional services industry

- The active role of SPRING, the government agency in Singapore in charge of promoting local SMEs, in promoting the development of an early-stage angel

investment community for high tech, IP-based start-ups, by providing matching investment funds

More recently, the Singapore government established the National Research Foundation (NRF), a new R&D funding agency to strategically fund "use-inspired" R&D in targeted new, emerging technologies beyond the current R&D focus of the public research institutes managed by A*STAR (e.g. clean-tech, interactive digital media, biomedical translational research). Besides providing strategically targeted R&D funding, NRF has also established a comprehensive framework ("National Innovation Framework") to facilitate the commercialization of IP generated from the R&D programs. The framework includes funding to improve the IP management and commercialization capabilities of the universities, SBIR-like funding specifically earmarked (as a percentage of R&D funding) for the funded program to explore commercialization feasibility, as well as providing matching funds to grow a number of early-stage VC funds focusing on high tech, IP-based start-ups, particularly spin-offs from the local universities.

5. Conclusion

Since 1997, the HKSAR government has certainly done well in terms of one aspect of IP policy: strengthening HKSAR's environment for IPR through the development of its IP legislative framework, improving the effectiveness of its enforcement institutions, and educating and raising public awareness of IPR. Nevertheless, based on the observations of this paper, I believe that a case can be made for a more strategic role of the government of HKSAR in terms of other aspects of IP policy intervention, if the government is indeed committed to driving HKSAR towards a

knowledge economy that is based on a more advanced innovation system. In particular, over and above the intensification of public investment in innovation activities in general and R&D activities in particular, the HKSAR government should consider taking a more active policy intervention role in terms of promoting the city-economy as a major hub in China and Asia for IP creation, commercialization and transaction. This would include promoting the development of her IP professional services industry and industrial design services industry, and strengthening the IP creation and commercialization capabilities of her universities and public research institutes to serve the needs of both HKSAR and the Pearl River Delta (PRD) region.

While the above proposed broadening of the government's IP policy role beyond IPR protection would represent a fundamental shift in the government's current laissez faire "positive non-intervention" approach, I believe that such a broader approach is necessary if HKSAR is serious about becoming an innovation driven economy.

Recommendations

1) Establishment of an IP Policy Review Panel

ITC should set up a high-level IP policy panel to conduct periodic strategic review of the IP policies of HKSAR to ensure that they are consistent with, and supportive of, the overall strategy of HKSAR to move towards an innovation-driven economy. While recognizing that the role of IP varies significantly with the nature of technology fields and business sectors, such a high-level review panel is necessary to ensure that IP-related issues are taken into consideration in implementing sector-specific innovation strategies. The panel should have appropriate representations from different

technology fields as well as involving industry experts from different IP professional services domains, so that IP policies can be formulated that take into account the specific challenges of different technology and business sectors.

One issue that the IP Policy Review Panel may want to look into is whether HKSAR should implement a patent examination system instead of the current registration system. Given that China has already implemented an examination system, HKSAR may want to harmonize its own system with that of China. In addition, as mentioned earlier, this may have significant impact on the development of IP professional expertise in HKSAR (see (2) below). The panel may also want to review the policy of maintaining a short-term patent system, which appears to be Hong Kong-centric and may not serve the need for HKSAR-based firms seeking to protect their IP internationally. .

2) Promoting the development of HKSAR's IP professional services industry to serve not just HKSAR, but also the Pearl River Delta (PRD) region

As HK's economy becomes increasingly integrated with that of PRD, a major emerging challenge is that of protection of IPR of HKSAR companies with production or sales activities in Mainland China. While there have been initiatives by both the government (particularly through IPD) and private sector organization (the Federation of HK Industries) to engage their Mainland Chinese counterparts to raise the level of IP protection in China, progress has so far been slower than hoped.

Another emerging concern is that as Mainland China evolves its own distinctive IP policy regimes, the IP professional services industry in HK may become increasingly bypassed, as foreign and HKSAR firms increasingly rely on IP services firms operating

within China itself that have much greater localized knowledge of the IP legal and business environment specific to different regions of Mainland China. My recent interviews with selected high tech firms and venture capital firms operating in the high tech hubs in Shanghai as well as Beijing Zhongguancun further reinforced the impression that high tech innovation in key high tech innovative hubs in Mainland China draw little engagement by HK venture capitalists, patent attorneys and licensing agents.

There is thus urgency for the IP professional services industry in Hong Kong to compete more strongly on a regional and international scale. Hong Kong has already lost much of its manufacturing base to its hinterland in the PRD and beyond. While the expected increase in R&D activities in the future will generate new sources of demand for IP professional services, they by themselves are unlikely to help support the growth of a critical mass of IP professional expertise in Hong Kong. Already, HKSAR has witnessed a steady shift of IP-related professional service activities to the emerging high tech hubs in Beijing, Shanghai and Guangdong regions in recent years. To arrest this declining role of HKSAR, there is a need for a stronger role by the HKSAR government to attract new investment into the IP professional services industry, and to promote the training and development of more specialized and sophisticated IP expertise not currently found in China, e.g.. by specializing in helping China-based firms to protect their IP internationally. Indeed, HKSAR can aspire to become a major IP management training hub for mainland China, especially for Chinese firms seeking to do business internationally. In addition to such an "outward-bound" training role, HKSAR can also play an "inward-bound" training role, training foreign IP firms and professionals that need to understand the intricacies of Mainland Chinese IP laws and business environment. As mentioned above, the adoption of a patent examination system, especially one that is

harmonized with China's, may give strong impetus to the development of the IP professional services industry in HKSAR

3) Providing greater public assistance for IP commercialization and exploitation services to local SMEs in HKSAR

Despite the growing presence of subsidiary operations of global MNCs, local SMEs remain an integral part of the economy of HKSAR. As shown earlier, a significant proportion of the patents generated in HKSAR is from individuals or local SMEs, which lack the resources and know-how to commercialize them. A substantially larger number of SMEs in HKSAR lack the resources to exploit the IP created by other SMEs as well as the IP coming out of universities and public research institutes. Even with the development of a stronger IP professional services industry, many of these SMEs are unlikely to be able to afford their expertise. As such, there is a role for the government to subsidize part of the IP transaction and exploitation costs for local SMEs and start-up entrepreneurs. Based on the experience of other economies like the US, Taiwan, Korea and Singapore, this can be structured in a number of ways, e.g. the SBIR grant scheme of the US to encourage high tech spin-offs, the ITRI-consortium licensing approach of Taiwan to facilitate rapid industry-wide innovation diffusion, or the TIP scheme of Singapore to promote fast adoption of new technologies by local SMEs by subsidizing the adoption cost.

4) Promoting the development of HKSAR as an industrial design industry hub that serves not just HKSAR companies, but also China and the Asia-Pacific region

Design represents an important form of IP in the knowledge economy and industrial design services constitute a key input to the product innovation process. HKSAR already enjoys a leadership role in industrial design in the region, as evident by its healthy growth in design patenting over the years. As more of HKSAR's manufacturing industries shift to the mainland and other lower cost locations in the region, HKSAR needs to focus more on pursuing other higher value adding services in the manufacturing value chain, including in particular industrial design services. More optimistically, HKSAR has the opportunity to expand the reach and richness of its industrial design services industry to service not just HKSAR firms operating manufacturing plants in the mainland, but also other firms in China and the Asia-Pacific region. Besides policies to attract more design firms to locate in HKSAR and to nurture indigenous design services firms, the government can look into promoting the train and development of not only technical skills in industrial design, but also design business skills and industrial design IP management expertise.

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ANNEX Table 1 Growth of Hong Kong and Singapore patents 1976-2007

	HK assignee patents by HK inventor	Foreign assignee patents by HK inventor	Total patents by HK inventor	Sg assignee patents by Sg inventor	Foreign assignee patents by Sg inventor	Total patents by Sg inventor
	No. of patents					
1976	17	7	24	2	1	3
1977	25	8	33	3	2	5
1978	27	3	30	0	3	3
1979	21	15	36	0	0	0
1980	44	9	53	1	5	6
1981	57	13	70	3	2	5
1982	67	6	73	6	0	6
1983	64	1	65	4	2	6
1984	58	20	78	4	0	4
1985	56	17	73	7	7	14
1986	106	11	117	3	2	5
1987	80	20	100	10	6	16
1988	91	23	114	5	7	12
1989	116	27	143	16	12	28
1990	109	55	164	6	15	21
1991	144	79	223	17	14	31
1992	123	50	173	13	28	41
1993	154	43	197	19	42	61
1994	180	58	238	29	50	79
1995	218	58	276	30	51	81
1996	218	55	273	54	70	124
1997	207	85	292	55	77	132
1998	306	105	411	90	91	181
1999	337	105	442	102	105	207
2000	422	138	560	179	120	299
2001	426	167	593	233	154	387
2002	394	184	578	296	237	533
2003	419	201	620	291	273	564
2004	347	201	548	273	320	593
2005	327	162	489	210	255	465
2006	411	243	654	284	299	583
2007	351	369	720	241	294	535
Total	5922	2538	8460	2486	2544	5030
	Annual growth rate (%)					
1976-86	20.1	4.6	17.2	4.1	7.2	5.2
1986-96	7.5	17.5	8.8	33.5	42.7	37.9
1996-00	18.0	25.9	19.7	34.9	14.4	24.6
2000-07	-2.6	15.1	3.7	4.3	13.7	8.7

Note 1: Where a patent is assigned to more than 1 country, it is allocated according to the country of the first-named company

Note 2: Patents by Hong Kong (Singapore) inventors include all patents with at least one inventor who is a Hong Kong (Singapore) resident

Note 3: Unassigned patents are allocated to Hong Kong (Singapore) assignees

Source: Database of the USPTO and NUS Patent Database

ANNEX Table 2 Growth of Hong Kong and Singapore Utility Patents 1976-2006

	HK assignee patents by HK inventor	Foreign assignee patents by HK inventor	Total patents by HK inventor	Sg assignee patents by Sg inventor	Foreign assignee patents by Sg inventor	Total patents by Sg inventor
	No. of patents					
1976	15	7	22	2	1	3
1977	9	4	13	1	2	3
1978	19	3	22	0	3	3
1979	8	10	18	0	0	0
1980	24	7	31	1	4	5
1981	28	8	36	3	2	5
1982	18	5	23	6	0	6
1983	18	1	19	5	1	6
1984	22	8	30	4	0	4
1985	20	12	32	6	7	13
1986	29	8	37	3	1	4
1987	26	13	39	10	5	15
1988	35	14	49	5	4	9
1989	39	17	56	15	7	22
1990	30	30	60	4	12	16
1991	34	23	57	9	12	21
1992	49	21	70	11	27	38
1993	46	24	70	14	41	55
1994	44	31	75	23	48	71
1995	71	36	107	26	45	71
1996	73	36	109	48	57	105
1997	68	32	100	54	67	121
1998	131	61	192	85	70	155
1999	112	68	180	98	99	197
2000	120	88	208	167	107	274
2001	181	92	273	229	144	373
2002	182	98	280	288	217	505
2003	197	99	296	282	241	523
2004	187	110	297	260	284	544
2005	161	78	239	190	242	432
2006	183	131	314	252	264	516
Total	2179	1175	3354	2101	2014	4115
	Annual growth rate (%)					
1976-86	6.8	1.3	5.3	4.1	7.2	5.2
1986-96	9.7	16.2	11.4	33.5	42.7	37.9
1996-00	13.2	25.0	17.5	36.6	17.1	27.1
2000-06	7.3	6.9	7.1	7.1	16.2	11.1

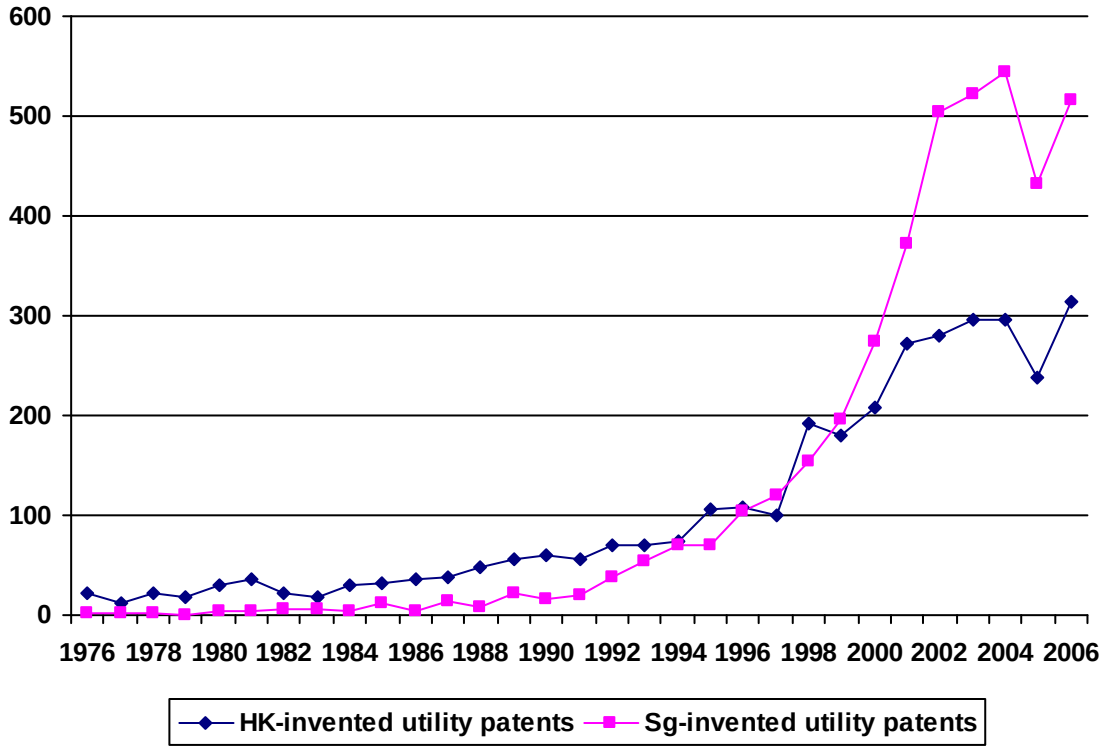
Note 1: Where a patent is assigned to more than 1 country, it is allocated according to the country of the first-named company

Note 2: Patents by Hong Kong (Singapore) inventors include all patents with at least one inventor who is a Hong Kong (Singapore) resident

Note 3: Unassigned patents are allocated to Hong Kong (Singapore) assignees

Source: Database of the USPTO and NUS Patent Database

Figure 1 Growth of Hong Kong-Invented Utility Patents vs Singapore-Invented Utility Patents 1976-2006



ANNEX Table 3 Utility Patenting Propensity, Selected Economies, 1985-2005

	Utility Patenting Propensity (Patents per 100,000 population)		
	1985	1995	2005
Japan	10.59	17.56	24.1
South Korea	0.1	2.62	9.2
Taiwan	0.91	7.83	22.9
Hong Kong	0.59	1.72	3.4
Singapore	0.47	2.0	9.8
China	0	0.01	0.05
India	0	0.01	0.05
USA	16.7	21.2	25.9
Germany	8.73	8.48	11.91
Ireland	0.88	1.83	4.81

Annex Table 4 Trademarks Applications and Registrations with USPTO

Fiscal Year ending September	Trademark Applications filed		Trademarks Registered	
	HK	Singapore	HK	Singapore
1990	285	48	82	9
1991	360	58	83	10
1992	484	66	130	17
1993	319	97	175	28
1994	396	172	160	23
1995	456	138	127	33
1996	456	110	168	45
1997	437	203	163	60
1998	478	161	169	49
1999	625	186	146	34
2000	1,097	419	194	44
2001	898	339	267	76
2002	860	283	288	82
2003	794	285	387	95
2004	862	205	391	102
2005	1,130	311	290	100
2006	1,113	355	373	110
2007	1,305	503	424	134
TOTAL (1990 – 2007)	12,355	3,939	4,017	1,051
Average Annual Growth (%)				
1990-1995	9.9	23.5	9.1	29.7
1996-2001	14.5	25.2	9.7	11.1
2001-2007	6.4	6.8	8.0	9.9

Annex Table 5 Comparison of Hong Kong and Singapore patents by patent type 1976-2006

	Hong Kong				Singapore			
	No. of patents				No. of patents			
	Utility	Design	Plant, Tissue	Total	Utility	Design	Plant, Tissue	Total
1976-85	295	318	1	614	56	7	0	63
1986-95	756	1169	2	1927	346	59	0	405
1996-00	920	1326	1	2247	912	95	0	1007
2001-06	2087	2191	7	4285	3253	233	6	3492
	% of patents				% of patents			
1976-85	48.0	51.8	0.2	100.0	88.9	11.1	0.0	100.0
1986-95	39.2	60.7	0.1	100.0	85.4	14.6	0.0	100.0
1996-00	40.9	59.0	0.0	100.0	90.6	9.4	0.0	100.0
2001-06	48.7	51.1	0.2	100.0	93.2	6.7	0.2	100.0

Note : Includes patents by at least one locally resident inventor and patents with the first-named assignee is locally listed

Annex Table 6 Breakdown of Patents by Hong Kong and Singapore Inventors[1] (Local vs Foreign Assignee) (1976-2006, Percentage)

	1976-85	1986-95	1996-06	Total	1976-85	1986-95	1996-06	Total
	Hong Kong (% of patents)				Singapore (% of patents)			
Local assignee	*81.5*	*75.7*	*69.9*	*72.0*	*57.7*	*39.9*	*50.8*	*50.0*
Private Company	49.5	55.5	48.2	49.9	23.1	21.5	34.8	33.6
University	0.0	0.3	3.7	2.7	0.0	3.5	4.6	4.4
Govt/PRIC	0.0	0.0	0.1	0.1	0.0	0.8	6.0	5.5
Individual/Unassigned	32.0	19.9	17.9	19.3	34.6	14.1	5.4	6.4
Foreign assignee	*18.5*	*24.3*	*30.1*	*28.0*	*42.3*	*60.1*	*49.2*	*50.0*
Private Company	17.8	23.6	29.0	27.0	36.5	58.8	47.5	48.3
University	0.0	0.3	0.3	0.3	3.8	0.5	1.2	1.1
Govt/PRIC	0.0	0.0	0.5	0.3	0.0	0.0	0.4	0.3
Individuals	0.7	0.5	0.3	0.4	1.9	0.8	0.2	0.2
Total	100.0	100.0	100.0	100.0	*100.0*	*100.0*	*100.0*	*100.0*

Note1: Patents where at least one inventor is a Hong Kong (Singapore) resident
Source: Database of the U.S. Patent and Trademark Office (USPTO) and NUS Patent Database
Unassigned included in individuals
Based on first-named assignee
Companies formed to commercialize university technology is counted under unis and PRICs

Annex Table 7a Average Citations Received per Utility Patent by Hong Kong and Singapore Inventors 1976-2006

	Hong Kong	Singapore
1976-85	10.9	6.5
1986-95	11.0	12.9
1996-06	4.0	4.2
OVERALL	5.8	4.9

Note: computed using citations up to 2006. Because of truncation effect, more recent patents tend to have lower forward citation counts due to having less time to attract forward citations

Annex Table7b Relative Citation Index, 1976-2005

Country of Invention	All Patents				Utility Patents			
	1976-85	1986-95	1996-2000	2001-2005	1976-85	1986-95	1996-2000	2001-2005
Hong Kong	0.847	0.708	0.745	0.977	1.105	0.943	0.938	1.153
Singapore	0.652	1.116	1.265	1.074	0.641	1.110	1.277	1.187

Annex Table 7c High Impact Index (top 5% most highly cited utility patents within 1-digit Technology Class), 1976-2005

Country of Invention	Using 1 digit Technology Class			
	1976-85	1986-95	1996-2000	2001-2005
Hong Kong	1.272	0.879	1.204	1.244
Singapore	0.000	0.970	1.616	1.268

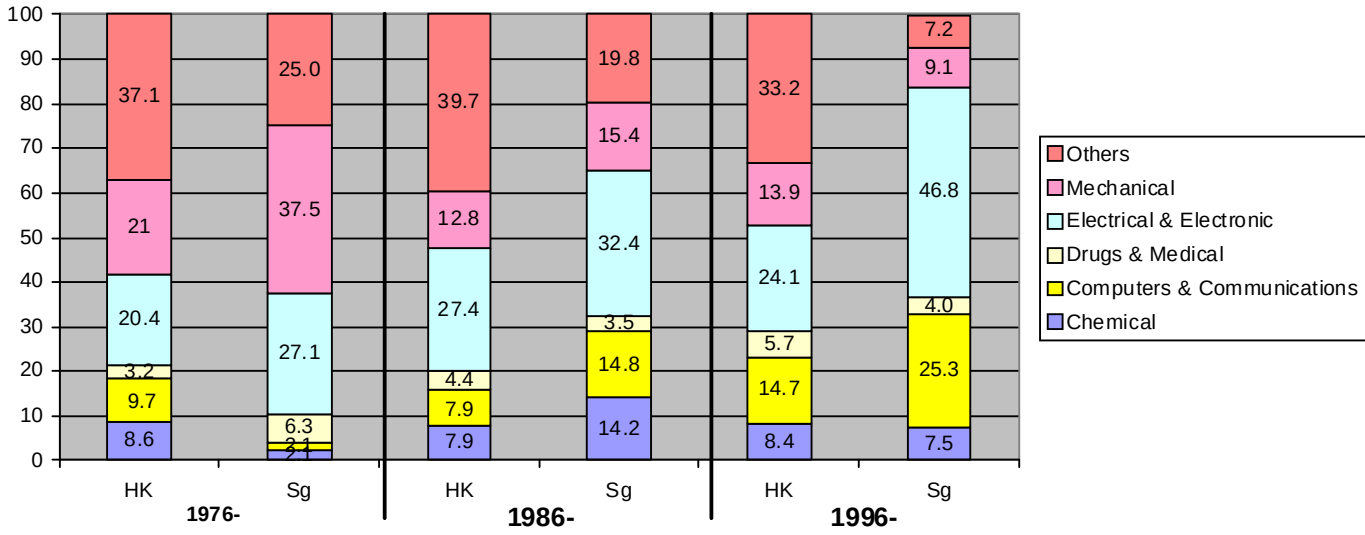
Annex Table 8 Herfindahl Index of Technological Concentration, 1976-2006

	Hong Kong	Singapore
1976-85	0.277	0.281
1986-95	0.203	0.211
1996-00	0.203	0.282
2001-06	0.194	0.312

Notes:
Nationality of Patent is defined as having at least one inventor resident in the specified nation
Herfindahl Index computed using classifications at the IPC Section level, with 8 categories in total.

Sources:
Computed from Database of the U.S. Patent and Trademark Office (USPTO) (various years) and the NUS Database of US Patents

Annex Figure 2 Comparison of technology class of patents by Hong Kong and Singapore inventors, 1976-2006



Source: Database of USPTO (various years) and NUS Patents Database
Patents include those where at least 1 inventor is a Hong Kong/Singapore resident

Annex Table 9a Top 20 Organizations with Hong Kong Patents[1]

No	*Companies*	*Country*	*Patent Count*				
			1976-85	**1986-95**	**1996 -00**	**2001 - 06**	**Cumulative Total as at end 2006**
1	John Manufacturing Ltd.	Hong Kong	9	170	115	41	335
2	Hong Kong University of Science & Technology	Hong Kong	0	1	27	53	81
3	Vtech Industries, Inc. [2]	Hong Kong	0	17	37	21	75
4	One World Technologies Limited	Hong Kong	0	0	0	70	70
5	Johnson Electric S.A. [3]	Hong Kong	1	49	13	2	65
6	Hayco Manufacturing Limited	Hong Kong	0	0	2	61	63
7	Astec International Limited	US	0	34	16	12	62
8	Choon Nang Electrical Appliance	Hong Kong	0	3	16	36	55
9	The Brinkman Corporation	US	0	8	2	42	52
10	Hong Kong Polytechnic University	Hong Kong	0	0	5	45	50
11	World Wide Stationary Manufacturing Co., Ltd.	Hong Kong	0	5	21	22	48
12	SAE Magnetics (Hong Kong)	Hong Kong	0	0	1	45	46
13	Gold Coral International, Ltd.	Hong Kong	0	0	0	45	45
13	Solar Wide Industrial Limited	Hong Kong	0	17	17	11	45
15	Rosalco, Inc.	US	0	44	0	0	44
15	Koninklijke Philips Electronics N.V. [4]	Netherlands	7	8	8	21	44
17	STD Electronic International [5]	Hong Kong	0	38	4	1	43
18	Motorola Inc.	US	0	11	22	9	42
19	Goodway Electrical Company Ltd.	Hong Kong	1	7	8	25	41
20	Alfa Technology Ltd.	Hong Kong	0	0	30	10	40
20	Timex Corp [6]	US	3	1	20	16	40

[1]Patents where at least one inventor is a Singaporean. The first assignee company is used to count patents which are assigned to more than one company.

[2]includes Vtech Communications Ltd, Vtech Electronics Limited, VTech Telecommunications Limited, Vtechsoft Holdings Limited

[3] includes Johnson Electric Engineering, Ltd, Johnson Electric Industrial Manufactory.

[4] includes North American Philips Corp., U.S. Philips Corp.

[5] includes STD Manufacturing Ltd., STD Plastic Industrial Ltd.

[4] includes Timex Group B.V.

Source: NUS Patents Database

Annex Table 9b Top 20 Organizations with Singapore Patents[1]

No	*Companies*	*Country*	*Patent Count*			
			1986-1995	**1996 2000**	**-2001 2006**	**Cumulative -Total as at end 2006**
1	Chartered Semiconductor Manufacturing	Singapore	14	190	581	785
2	Hewlett-Packard Company	United States	23	52	141	216
3	Seagate Technology	United States	0	15	200	215
4	National University of Singapore	Singapore	12	35	115	162
5	Micron Technology Inc	United States	0	0	135	135
6	Motorola Inc	United States	24	47	34	105
7	Texas Instruments	United States	18	42	37	97
8	Koninklijke Philips Electronics., N.V.[2]	Netherlands	10	15	63	89
9	Institute of Microelectronics	Singapore	1	18	62	81
10	ST Assembly Test Services	*Singapore*	1	*2*	*78*	81
11	Matsushita Electric Industrial Co.	Japan	3	24	49	76
12	Agency for Science, Technology, and Research	Singapore	0	0	57	57
13	STMicroelectronics	Italy/France	2	17	38	57
14	*Tri-tech Microelectronics*[3]	United States	3	49	4	56
15	Creative Technology	Singapore	0	9	46	55
16	Advanced Micro Devices	United States	0	9	43	52
17	Thomson SA	France	15	10	20	45
17	ASM International NV[4]	Netherlands	0	0	41	41
19	Infineon Technologies	Germany	0	0	41	41
20	Molex Incorporated	United States	26	7	5	38

[1]Patents where at least one inventor is a Singaporean. The first assignee company is used to count patents which are assigned to more than one company.

[2]includes US Philips Corp

[3] A company called Tri-tech Microelectronics was granted a total of 56 patents before filing for bankruptcy and entering liquidation in 1999.

[4] includes ASM Technology Singapore

Source: Database of the U.S. Patent and Trademark Office (USPTO) (various years)