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SINGAPORE

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I. INTRODUCTION

Singapore is a young nation and a recent entrant to the interface between intellectual property (IP) rights and competition law ("the Interface"). Singapore started developing its IP regime from the 1980s, partly because of pressure from major trading partners to provide stronger protection for intellectual property originating from these countries and partly because it was determined to move up the value chain as a matter of economic strategy.[1] The history of competition law in Singapore is even more recent. Singapore introduced a general competition law regime following the recommendations of the Economic Review Committee in 2003 and in keeping with its obligations under the US-Singapore Free Trade Agreement.[2] Substantive portions of the Competition Act came into force in stages from 2006 and it is administered by the Competition Commission of Singapore (CCS).[3]

♦ Ashish Lall contributed the economic framework section of the chapter.

♦♦ Daryl Lim contributed the legal framework section of the chapter. The best thoughts in the section were inspired by discussions with colleagues at the Federal Trade Commission in Washington D.C. during his summer internship on the staff of Commissioner William E. Kovacic, as well as from his participation in the Asian Competition Forum's 5th Annual Conference in Hong Kong. He gratefully acknowledges the pioneering work of Professors R. Ian McEwin, George Wei, Ng-Loy Wee Loon and Burton Ong.

[1] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 16 (Rev. Ed, 2009) ("Singapore is an expert in using the IP system as a tool to achieve significance for Singapore when it became clear in the mid-1980s that software could be protected within the copyright regime. To encourage the growth of the software industry here, a major revamp of its copyright law was undertaken and the result was the Copyright Act passed in 1987…. The same focused approach is taken with patents: the moment the policy-makers saw the need to move Singapore into emerging fields such as biotechnology, a new Patents Act was passed in 1994".)

[2] Cavinder Bull *et al*, *Competition Policy and Law* in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 7(2009). ("A number of FTAs concluded by Singapore included provisions relating to the regulation of competition issues. One of the landmark FTAs was the United States-Singapore ("USSFTA") which set out extensive competition-related obligations…. In particular, Article 12.2 of the USSFTA requires Singapore to (a) adopt or maintain measures to proscribe anti-competitive business and (b) establish an authority responsible for the enforcement of the measures to proscribe anti-competitive business conduct.") Competition law was also introduced due to the recommendations of the Economic Review Committee in 2003 to "create a level playing field for businesses, big and small, to compete on equal footing". See Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 9 (2009).

[3] Cap 50B, 2006 Rev Ed. For a comprehensive summary of the CCS see Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 14-17 (2009).

Singapore has ramped up its research and development (R&D) as it seeks to transition to an innovation based economy. There has been a significant increase in R&D inputs in recent years, both in terms of dollars and personnel. In 2008, the total number of (full time equivalent) researchers was 27,841 and gross domestic expenditure on R&D was US$ 6.6 billion (current purchasing power parity (PPP) adjusted dollars); with the private sector accounting for about two-thirds of the expenditure.[4] Singapore's ability to attract researchers from other countries shows up in bibliometric studies which show that Singapore has a very high rate of growth in the number of publications in areas such as nanotechnology and biotechnology.

This paper argues that the key to navigating the Interface in Singapore includes understanding the nature of IP markets in Singapore and fostering synergies between the key institutions responsible for the IP and competition regimes. Because Singapore adopts a regulatory self-assessment system, firms with substantial IPRs in Singapore need to fully understand the Interface to avoid what may be costly mistakes.[5] The discussion of the economic framework first provides background on the economic structure of Singapore illustrating the role of location and legacy in sectors that continue to be important today. The second part discusses Singapore's innovation performance based on international innovation rankings as well as on standard measures such as patents, research and development expenditures and personnel. It suggests that Singapore is not yet an innovation-based economy despite the recent increase in innovation inputs. The discussion of the legal framework first surveys IP issues arising from anticompetitive agreements, abuse of dominance as well as mergers and acquisitions. The second part highlights the challenges and opportunities relevant to Singapore as a small open economy trying to move up the technology value chain and concludes by suggesting a number of ways Singapore can better navigate the Interface.

[4] See p 18 in OECD, *Main Science and Technology Indicators*, Volume 2010/1, (Paris, OECD, 2010).
[5] Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 20 (2009). ("To minimize the regulatory and compliance burdens on business, the CCS emphasises the need for self-assessment and voluntary compliance by businesses.")

II. THE ECONOMIC FRAMEWORK

A. Singapore's Economic Structure

In 1965 Singapore's per-capita gross domestic product (GDP) was $2,667 (in 1990 PPP adjusted international dollars). By this measure, average incomes in Singapore were the third highest in Asia after Japan and Hong Kong. Between 1965 and 2008, average incomes in Singapore grew by about 3.5% per annum (Table 1) and in 2008 Singapore's per-capita GDP ($28,289) was below only that of Hong Kong ($29,825), Norway ($29,140) and the United States ($31,328).

Economic growth is accompanied by structural change, however many of the sectors which continue to make significant contributions to the Singapore economy have legacies related in one way or another, to Singapore's location on international shipping routes and the foresight of Sir Stamford Raffles who founded Singapore in 1819 and established it as a free port. Examples include shipping, ship-repair and associated services such as finance and insurance; petroleum refining and the associated petro-chemical value chain. The availability of engineering skills which facilitated structural change toward manufacturing after 1965 is also attributed to the presence of rubber milling and tin refining in the late 19th and early 20th century. The growth of many of these sectors was due to technological changes and fortuitous events that took place elsewhere but had a considerable impact on the development of Singapore.

Factors which contributed to the development of the port and ancillary activities include the opening of the Suez Canal in 1869 which gave Singapore an edge compared to other ports in the Malayan peninsula such as Penang and Malacca.[6] A second development was the advent of the steamship. The increase in vessel size reinforced the importance of larger ports such as Singapore and led to the development of a hub and feeder system. By the First World War Singapore's port was the seventh busiest in the world in terms of shipping tonnage handled. After independence the government made an early bet by setting up a container terminal in the early 1970s; much before container shipping was well established. In 2010, Singapore's port was the second busiest container port in the world (after Shanghai) handling about 28.4 million TEUs (twenty-foot equivalent units).

Singapore is also a leading centre in the world for ship repair, tanker repair and the construction of petroleum drilling rigs and support ships. The development of these industries can also be traced back to

[6] The historical overview draws heavily on A Lall, 'Canada's Pacific Gateway' Paper prepared for Vancouver Conference under Government of Canada's Asia-Pacific Gateway and Corridor Initiative, Vancouver, B.C., Canada, 2-4 May 2007.

the early 20th century. By 1913 Singapore had five dry docks – the fifth (King's dock) was built to the specifications of the Admiralty as the British established a naval base in the north of Singapore in 1928. When the British left Singapore in 1967, the shipyard was taken over by the government which used the infrastructure for the ship repair industry.

The development of related industries and other 'clusters' though linked to the development of the port are also explained by Singapore's vast hinterland. Huff (1994) argues that in the late 19th century and until 1960, Singapore was a 'staple port' or one which exported surplus natural resources from the hinterland.[7] In the late 19th century tin was exported from the Malayan peninsula and later in the 1920's rubber from Malaya and petroleum from the Dutch East Indies. Favourable geography was a necessary condition for staple ports and this led to an expansion of facilities required to handle a greater volume of goods and shipping. Other requirements included entrepreneurial, investment, management and mercantile functions connected with the staple – which essentially turned the port to a commercial centre.
Between 1874-77 and 1896-99 Malayan tin production increased more than six-fold growing from one fifth to over one half of world output due to demand for tin plate in the West, which was attributed to two innovations: canned food and the use of barrels for transporting petroleum. By 1899-1900 the world's largest and most technically sophisticated tin smelting facility was located in Singapore and the port was also the world's largest exporter of tin.

In the inter-war period Singapore was the largest centre in the region for re-milling small-holder rubber. The demand for rubber and petroleum increased due to demand for motorized transport. Between 1913 and the 1930s the United States imported half to three quarters of world rubber production. The auto industry accounted for three quarters of rubber imports into the United States. The market for petroleum also got a boost due to the conversion of mercantile marine fleet to oil-fired ships. After the First World War oil majors developed production facilities in British Borneo and the Dutch East Indies and used Singapore to collect, blend and distribute products such as petrol, kerosene and fuel oil for bunkering. Oil companies were drawn to Singapore because of its local and international geographical advantage and freedom from regulation. Petroleum exports were four times greater in volume in the 1950s than in 1937-38. The Royal Dutch Shell Group maintained its headquarters for its Far East shipping fleet in Singapore. In 1959 Caltex started marketing operations; oil refining started in 1960 and by 1980 Singapore was the largest bunkering centre in the world.

[7] WG Huff, *The Economic Growth of Singapore: Trade and Development in the Twentieth Century* (Cambridge, Cambridge University Press, 1994).

Government built on legacy industries such as shipping, ship-repair and petroleum refining and the linkages of tin refining and dry docks to the local engineering industry provided a skill base which allowed Singapore to move to a model of export-led growth based on heavy foreign direct investment (FDI) after the 1960s.

Between 1988 and 2001, the ratio of Singapore's total trade (goods and services) to GDP fluctuated between 3.0 and 3.5, however, since 2002, this ratio has increased more or less monotonically and it stood at about 4.5 (3.5 for goods and 1 for services) in 2008. Total merchandise trade increased from US$43 billion in 1980 to $658 billion in 2008, representing an annual growth of 10.2%. Export growth of goods (at 10.75% per annum) outpaced growth in imports (9.69%) over the period of 1980 to 2007. Entrepöt trade is an important component of Singapore's trade. In 2008, re-exports accounted for 42.62% of Singapore's total exports. Growth in re-exports accounted for 51.13% of total export growth between 1990 and 2008. Singapore's re-exports are dominated by high-tech products, and this pattern has become more pronounced over time. The share of high-tech products in total re-exports increased from 63.22% in 1995 to 67.17% in 2008. The other important product category is petroleum and related products.

Foreign investment accounts for about 80% of gross fixed capital formation in Singapore. This is one of the highest rates in the world with only Hong Kong relying even more on foreign capital to finance investment. As a proportion of GDP, FDI inflows doubled from 82% in 1991 to 171% in 2007. Traditionally manufacturing and financial services attracted most of the FDI inflows. Since 2004, finance has outpaced manufacturing as a target for FDI. Western foreign firms continue to dominate investments in the manufacturing sector with the United States continuing to be the leading investor. In 2007, local investment accounted for 28% of gross fixed investment in the manufacturing sector; the United States accounted for 29%; Japan for 16% and European countries for another 18%. These shares have remained remarkably stable since 1997. Table 2 shows that foreign investors continue to be attracted to Singapore of the high returns they obtain from their investments.

While Singapore maintains an open trading environment, the domestic economy is not led by the local private sector, but is one in which the government and multinationals play a substantial role. Local small and medium scale enterprises (SMEs) only dominate general manufacturing and real estate and business services; all other sectors are dominated by foreign firms or large (generally government-linked) local firms. There are various estimates of the number of government-linked companies (as many as 600) and their contribution to GDP (from 13% to 60%), however they are just estimates as many government-linked

companies are exempt from filing public accounts.[8] Table 3 shows that foreign firms generate higher revenues and net income per employee than either government-linked or local private firms.

Singapore is often cited as an example of 'state capitalism' where government uses various tax and other incentives to both attract foreign investment and to direct investment to 'targeted' sectors. The process of structural change is more a matter of state direction rather than an outcome of market forces. Young (1992) argues that this fast pace of structural change comes at the cost of low total factor productivity, which is the driver of sustainable economic growth.[9] At an aggregate level however the structure of the economy shows remarkable stability. Over the period 1990-2008, the share of the manufacturing sector in total output (or GDP) has remained at about 25% and this is not by accident but by design. Over the same period, the employment share of manufacturing declined from 30% to 20% reflecting the shift to higher value-added sectors (or sectors with higher capital intensity). However, the most important sectors continue to remain the same and include petroleum, chemicals, pharmaceuticals, electronics, transport equipment and machinery and equipment. In 2007 these sectors accounted for 85% of the gross output of the manufacturing sector and 88% of manufacturing exports. The share of the services sector in GDP increased from 60% to 66% and the employment share of services increased from 62% to 67%. Wholesale and retail trade was the largest service sector contributing to 16% of output and 14% of employment in 2008, while financial services accounted for 13% of output.

While Singapore's broad strategy remains the same, over the years government has used various policy levers to encourage the transition to higher value added industries in manufacturing, followed by a push toward the service sector and more recently toward innovation-intensive sectors such as biotechnology, water and clean technologies. Often these and other changes are driven by exogenous factors and events; for example, the deregulation of telecommunication in 2000 was brought forward by two years to remain competitive with Hong Kong.

B. International Innovation Rankings

[8] See pp 260-264 in G Hopf, *Saving and Investment: The Economic Development of Singapore 1965-1990* (Saarbrücken, VDM Verlag Dr. Müller, 2009).

[9] A Young, 'A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore' in OJ Blanchard and S Fischer (eds), *NBER Macroeconomics Annual 1992* (Cambridge, MA., The MIT Press, 1992).

In recent years there has been a proliferation of rankings and their popularity has risen as well. It would appear that everything can be reduced to a single number including measures of the quality of governance and judicial systems. Nonetheless, there appears to be considerable interest in rankings and countries such as Saudi Arabia and Kazakhstan have used them to set national objectives. Saudi Arabia for example, sought to be ranked in the top ten in either, the World Investment Report, the World Bank Doing Business Rankings or the World Economic Forum Global Competitiveness Rankings by 2010.[10] The Saudi government also hired strategy consulting firm Monitor Group to help it achieve this objective. Generally, rankings are of limited use from a prescriptive or policy viewpoint however, they could be used as a quick-and-easy benchmarking tool. Unfortunately, as is shown below using innovation rankings, this can sometimes prove challenging. Data, methods of aggregation and metrics differ across rankings and understanding these requires de-constructing the rankings. Doing so however, defeats the purpose of constructing them in the first place.

The World Bank's 'Knowledge Index' and 'Knowledge Economy Index' measure a country's ability to generate, adopt, and diffuse knowledge.[11] The former is based on three pillars: use of information and communications technology (ICT); education and human resources and the innovation system. The latter includes an additional pillar: economic incentive and institutional regime. Use of ICT is measured by per-capita penetration of computers, telephones and the internet. Educational attainment is measured using adult literacy rates as well as enrolment in secondary and tertiary education. The innovation system measure is based on U.S. patent grants, royalty payments and bibliometric data. These three measures are aggregated to arrive at the Knowledge Index. Taiwan (14th) was the highest ranked Asian country in 2009 while Singapore ranked 26th. Singapore's ranking is dragged down by the education metric on which it ranks 70th. Adding the economic pillar which includes measures of tariff and non-tariff barriers, the quality of regulation and the rule of law, helped Singapore's standing as it's rank in the Knowledge Economy Index was 19th, or, second in Asia, just after Taiwan (18th).

Most other cross-country comparisons of innovation use the notion of innovation inputs and outputs and in addition some include measures of the innovation environment. The Economist Intelligence Unit-Cisco Innovation Index uses this approach.[12] Innovation output is measured by patents granted by the European, Japanese and U.S. patent offices. Innovation inputs include measures of research and development (R&D) expenditure, educational and technical skills and the quality of ICT infrastructure. The innovation

[10] www.saudincc.org.sa/getdoc/f4e88d1e-96b5-4ad5-b3b1-3fd84a693e31/How-Competitiveness-is-Assessed.aspx.
[11] go.worldbank.org/JGAO5XE940.
[12] Economist Intelligence Unit, *A New Ranking of the World's Most Innovative Countries* (London, EIU, 2009)

environment is measured by factors such as policies towards trade and investment, the political environment, taxes, availability of financing, the labour market and infrastructure. In constructing the index of "innovation enablers", innovation inputs are given a higher weight (75%) than indicators of the innovation environment. Based on 2004-08 data, Singapore ranked 2nd (after Denmark) on environmental factors, but its overall rank on both enablers as well as output or "innovation performance" was 16th. Japan was in first place whereas Taiwan was ranked 7th and South Korea 11th.

In 2009, The Boston Consulting Group (BCG), the National Association of Manufacturers, and the U.S. Manufacturing Institute released an international innovation index comparing innovation inputs and performance across countries.[13] The scope of both measures is very wide and includes measures of economic growth, employment growth, the level of taxation, high-tech exports and labour productivity. Singapore ranked first overall on innovation inputs, but it ranked ninth on innovation output and performance. While it is highly implausible that Singapore is the most innovative country in the world, these results point to the Singapore's inefficiency in producing innovation outputs. For example, Singapore's innovation input score was 2.74 whereas that of Hong Kong was 1.61. Yet, Hong Kong's (ranked 6th overall) innovation performance score was 1.97 compared to Singapore's score of 1.92.

INSEAD and the Confederation of Indian Industry released their third global innovation rankings for the year 2009-2010.[14] Innovation inputs were measured using five pillars: institutions, human capacity, general and ICT infrastructure, markets sophistication and business sophistication. Innovation outputs included scientific outputs, creative outputs and benefits to social well-being. Many of the measures draw from the Global Competitiveness Report data and data on creative outputs are drawn from UNCTAD which includes production and exports of tangible products or hardware used in creative industries including compact discs, music players etc.[15] Overall, Iceland was ranked the most innovative country and Hong Kong was third, followed by Singapore (7th), United States (11th) and Japan (13th). Singapore's rank on the input and output pillars was third and twelfth respectively.

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[13] Boston Consulting Group, *The Innovation Imperative in Manufacturing: How the United States Can Restore Its Edge* (BCG, Boston, 2009).

[14] INSEAD, *Global Innovation Index Report 2009-2010* (www.globalinnovationindex.org/gii/main/home.cfm). Note that there is a lot of volatility in the rankings compared to the previous year 2008-2009. For example South Korea was ranked 20th in 2009-2010 as opposed to sixth in 2008-2009 and Iceland was ranked 20th in 2008-2009 and first in 2009-2010.

[15] The Global Competitiveness Report is an annual publication of the World Economic Forum.

The 2009 Innovation Index of the Information Technology and Innovation Foundation (ITIF) in the United States also gives a large weight to indicators of economic performance.[16] These include general economic business environment indicators such as trade balance, foreign direct investment, corporate tax rates and the World Bank's doing business rankings and new business registration data. Singapore was ranked first – or the most innovative country in the world; South Korea – fifth and the United States – sixth. Singapore had low ranks in areas such as e-government (21st), scientific publications (22nd) and broadband (14th).

Generally, Singapore ranks reasonably well (in the top-20) in international innovation rankings and its standing is higher in indices which include either general economic metrics such as tax rates, economic growth, export performance and ability to attract foreign direct investment or business environment metrics such as the costs of doing business. Singapore also does well in rankings which include measures of government support for innovation. However, Singapore tends to perform better on measures of innovation inputs than on outputs. The next section provides comparative data on more specific metrics of innovation outputs such as patents, trademarks and copyright registrations.

C. Innovation Metrics

Innovation is a complex phenomenon and not just restricted scientific research and development activities. Firms may make process and organizational innovations and increasingly customers and other business partners are playing an important role in collaborative or open innovation. Ultimately, to fuel economic growth, innovation should lead to commercialization or the introduction of profitable new products, services, or methods of delivery. Singapore is moving toward an innovation based economy and government has devoted a considerable amount of funds to research and development since 2000. Innovation is difficult to measure so researchers rely on readily available intellectual property registration data as measures of output and R&D expenses and personnel as measures of inputs into the innovation process.

Table 4 shows Singapore's global share of intellectual property including patents, trademarks, industrial designs and utility models or petty patents. While Singapore's share is small, it appears to have made some progress. Its share of approved patents increased from 0.18% in 2001 to 0.62% in 2007 – a factor of three and that of approved trademarks increased from 0.24% in 2001 to 0.66% in 2007. Table 5 shows the average (2001-2007) number of approved patents, trademarks and industrial designs and also presents more

[16] RD Atkinson and SM Andes, *The Atlantic Century: Benchmarking EU and U.S, Innovation & Competitiveness* (Washington D.C., The Information Technology and Innovation Foundation, 2009).

recent data on a per-capita basis (per 10,000 population). So for example, on average about 748 patents were granted to Singapore residents over the period 2001-2007 which translates to about 1.62 patents per 10,000 population. In general, Singapore looks somewhat similar to Ireland; it does better than Hong Kong on all measures except industrial designs, but is generally behind OECD and Scandinavian countries. U.S.-registered patent data (Table 6) show that Singapore's patenting rate per-capita (per-million population) is comparable to countries such as Denmark and the Netherlands. However, countries like Finland, Israel, Switzerland, Japan, South Korea, and Taiwan continue to outperform Singapore. Singapore has shown strong growth, but on this measure, countries such as India and China have outpaced Singapore by a factor of two to three. Despite the recent push towards new areas such as biotechnology, Singapore has a strong focus on electrical engineering, which is very similar to South Korea and Finland (Table 7).

Singapore amended its intellectual property laws about a decade ago and trademarks, industrial designs and patents can since be registered at the Intellectual Property Office.[17] Table 8 provides data on filings and approvals in Singapore and filings and approvals by Singapore residents. In other words it asks: which are the top five countries that file (and get approved) for intellectual property in Singapore? And in which countries do Singapore residents file (and get approved)? For patents, the United States and Japan and the top applicant countries in Singapore, whereas for trademarks and industrial designs, Singapore residents are the top applicants followed by either the United States or Japan. Singapore residents show a clear domestic preference for obtaining trademarks and industrial designs, but they prefer to file for patents in the United States.

Singapore has made great strides in strengthening its research inputs, particularly over the last decade or so. Table 9 shows a consistent increase in both spending and personnel since 1994. Research scientists and engineers per-thousand of the total labour force increased at an average annual rate of 5.9% from 1994 to 2008 and R&D expenditures per capita grew at 10.8% per annum over the same period. In absolute terms however some corporations have a larger R&D spend than Singapore. In 2007, gross expenditure on R&D (GERD) in Singapore was S$6.34 billion, with the private sector accounting for about two-thirds (S$4.23 billion) of the expenditure. In contrast, Sony Corporation which was ranked 20th in a global survey of corporate R&D spending, reported R&D spending of about S$ 6.8 billion in 2007.[18]

[17] Utility models or petty patents are not recognized in Singapore and Singaporean residents are not significant users of utility models. Over the period 2000-2007 Singaporean residents accounted for a total of 51 filings and 26 approvals. The most important location was China, which accounted for about 60% of both filings and approvals, followed by Germany and Australia. See WIPO utility model database available at: wipo.int/ipstats/en/statistics/models/

[18] B Jaruzelski and K Dehoff, 'Beyond Borders: The Global innovation 1000' (2008) *Strategy+Business*, issue 53, reprint No. 08405, Booz & Company, available at: www.strategy-business.com.

In 2008 government's share in total R&D spending in Singapore was about 18% which was higher than in OECD countries and slightly lower than in Taiwan (Table 10). In comparison, the share of higher education in total R&D spending (9.9%) was almost equivalent to that of South Korea and among the lowest in comparison to all OECD and Scandinavian countries. About half of all R&D spending is focused on the electronics sector and within that sector an overwhelming proportion of the expenditure is on semiconductors. Further, most of the R&D expenditure is on experimental development, rather the on applied or basic research – basic research is minimal. There is little evidence that private R&D spending has gone into 'new' areas like biotechnology, where government has made major investments. As shown in Table 11, countries such as Taiwan and South Korea also have a focus on electronics, whereas OECD countries such as Germany, Japan, the United Kingdom and the United States have a much more diverse research portfolio. Tables 12 and 13 show that Singapore compares quite well OECD countries on both R&D researchers and personnel, but the focus appears to be on the former as Singapore's researcher population (10.22 per 1,000 employed workers) places it in the top four, ahead of every Asian country except Japan. Singapore also has comparatively more public institute research personnel per 1,000 employed workers than any other country except the UK.

Singapore has also taken many steps to provide an attractive environment for science-related investments. In terms of intellectual property rights, Singapore's legal regime of protection is "TRIPS-plus," and the country has recently emerged as one of only three Asian countries (along with Japan and Taiwan) on the list of the top twenty-five countries in the world with the lowest software piracy rates. The Agency for Science, Technology and Research (A*STAR) is the national research body that oversees public sector R&D activities in Singapore. It not only manages R&D activities, but has education and commercialization arms, as well. Singaporean firms however, both government-linked as well as private do not stack-up internationally. The 2008 R&D scoreboard produced by the UK government ranked 1,400 firms based on their 2007/08 R&D investment.[19] Only two Singaporean firms appear on that list – Creative Technologies was in position 966 and government-linked Singapore Technologies Engineering was in position 1204.

D. Appraisal

Singapore has a successful economic model and a government which places a very high priority on economic prosperity. In addition, it has been successful in capitalizing on its location advantage and built

[19] www.innovation.gov.uk/rd_scoreboard/?p=68.

on its legacy of being open to foreign trade and investment. The efficiency driven model has served Singapore well and continues to provide economic gains, however the move toward an innovation driven economy has yet to take root. Singapore performs very well on innovation measures that take into account the business environment and indeed government has provided support for innovation through higher expenditures and attempting to fill the manpower gap by recruiting scientists and engineers from other countries. On the innovation input side therefore Singapore is well ahead of Asian peers and looks like an OECD country. However, this is not the case on the output side. Output metrics show that Singapore has some way to go in comparison not only to OECD and Scandinavian countries, but also to Taiwan and South Korea which outperform Singapore despite their lower GDP per-capita.

III. THE LEGAL FRAMEWORK

A. Law

The Competition Act is largely based on UK legislation,[20] and seeks to promote the efficient functioning of the markets in Singapore and to enhance the competitiveness of the economy through prohibiting anticompetitive activities that unduly prevent, restrict or distort competition.[21] Within a relatively short amount of time, Singapore has installed the institutional framework and expertise mirroring the best practices from the world's leading competition authorities.[22] One example of this is the CCS IP Guidelines, which incorporates a distilled blend of EU and US jurisprudence, firmly grounded in contemporary economic analysis.[23]

Singapore's competition law is concerned with total welfare rather than simply consumer welfare.[24] Flowing from this, the effective of anticompetitive agreements, for example, are assessed not merely on the

[20] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 1 (2007) ("(The [Competition] Act is largely based on the Competition Act 1998 (UK) … and Enterprise Act 2002 (UK).")

[21] Vivian Balakrishnan, (then-Senior Minister for Trade and Industry) Second reading speech for the Competition Bill. (October 19, 2004, Hansard Vol. 78, col 863) ("Sir, the objective of the Bill is to promote the efficient functioning of our markets and hence enhance the competitiveness of our economy. The Bill seeks to prohibit anti-competitive activities that unduly prevent, restrict or distort competition.")

[22] Vivian Balakrishnan, Second reading speech for the Competition Bill. (October 19, 2004, Hansard Vol. 78 col 863) ("MTI subsequently studied the competition legislation of various jurisdictions, including the UK, Australia, Ireland, the United States and Canada.").

[23] See for example, Commission Regulation (EC) No 772/2004 on the application of Article 81(3) of the Treaty to Categories of Technology Transfer Agreements (April 27, 2004) and the 1995 Antitrust Guidelines for the Licensing of Intellectual Property issued by the U.S. Department of Justice and the Federal Trade Commission (April 6, 1995). See also the Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition: A Report Issued by the U.S. Department of Justice and the Federal Trade Commission (April 2007).

[24] Competition Bill Consultation Paper, issued 12 April 2004 by Singapore's Ministry of Trade and Industry (available online at www.ccs.gov.sg/archival-First.html), Annex C (The Relationship between Competition Law and Intellectual Property rights) at <para. 7 to 10>. ("In considering whether a business activity involving the exercise of IPR would have any competition concerns, the Competition Commission of would adopt an 'economics-based' or 'rule of reason'

basis of tradeoffs between consumer benefit and harm. Instead, the CCS may accept producer efficiency arguments showing producer benefits even if consumers do not visibly benefit from the process. [25]

Anticompetitive Agreements: Section 34 of the Competition Act prohibits agreements or concerted practices between undertakings and to decisions by associations of undertakings with the object or effect of appreciably "preventing, restricting or distorting" competition within Singapore.[26] Entities engaging in commercial or economic activities[27] which knowingly cooperate[28] or concur in any form[29] to substitute competitive risks with the benefits of collusion are thus prohibited. Agreements running afoul of the Act attract financial penalties[30] and can be declared void.[31] At the Interface, the main focus of section 34 is on anticompetitive clauses in licensing agreements.

The CCS IP Guidelines provide some guidance on the CCS' possible approach to IP rights.[32] They set out a three step process to assessing licensing agreements. First, agreements between competitors are more

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approach. This means that the Competition Commission would take a holistic view and look at the overall net welfare effects of the activity to decide whether a particular use of an IPR reduces welfare in Singapore.")

[25] Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 19-20 (2009). ("For instance, in the European Community, Article 81(3) of the EC Treaty requires that consumers receive a "fair share' of any efficiency benefits before agreements can enjoy the exemption from Article 81(1) prohibiting anti-competitive agreements. What this means is that the positive effects of an agreement must compensate for the negative effects on consumers.[referring to the European Commission, Guidelines on the Application of Article 81(3) of the Treaty [2004] OJ C101/97.] Singapore has however, deliberately removed that specific requirement of consumers receiving a fair share of any efficiency benefits from its Net Economic Benefit test which is similar to Article 81(3). … This strongly suggests that the CCS will consider the impact of an agreement on the total welfare of society (that is, consumer as well as producer welfare) instead of just focusing on consumer welfare. Practically what that means is that the CCS will be more open to accepting efficiency arguments arising from restrictive agreements that may benefit producers but that do not provide any benefits to consumers.")

[26] Section 34 of the Competition Act. For a generic introduction to Section 34, see Richard Wish, *Anti-competitive Agreements*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) Chapter 3(2009).

[27] Para 2.6. CCS Section 34 Guidelines.

[28] Para 2.17 gives factors to be considered in establishing whether a concerted practice exists.

[29] *Bayer AG v Commission* (ADALAT) Case T-41/96, [2000] ECR II-3383, [2001] 4 CMLR 126 at [69]. (Noting that the concept of an agreement "centres around the existence of a concurrence of wills between at least two parties, in the form in which it is manifested being unimportant as long as it constitutes the faithful expression of the parties' intention.")

[30] Section 69 of the Act.

[31] Section 34(3) of the Competition Act. Richard Wish, *Anti-competitive Agreements*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 109 (2009) ("Where a provision is void as a result of the operation of section 33(3) of the Act, it would be a matter of contract law to determine whether the loss of that provision leads to the consequence that the agreement in its entirety becomes unenforceable. ")

[32] The CCS Guideline on the Treatment of Intellectual Property Rights. Available at www.ccs.gov.sg/Doc/FinalisedGuidelinesDec05/GuidelineRevised_IPRs_Dec05.pdf Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 402 (Steven D. Anderman ed., 2007). ("Guidelines issued by the CCS are policy statements which reflect the Singapore competition regulator's analytical approach towards the interpretation and application of the statutory prohibitions found in the Competition Act 2004. The contents of the

likely to be anticompetitive.[33] The CCS is, in particular, concerned with restraints between competitors that fix prices, divide markets, limit outputs or reduce incentives to carry out independent R&D.[34] The CCS IP Guidelines focuses on anticompetitive effects toward technological innovation,[35] and expressly exclude trademarks.[36]

Agreements between non-competitors are regarded to have more adverse impact on competition where one or more of the undertakings enjoy "high market power" and "forecloses access to, or increases competitors' cost to obtaining inputs"[37], preventing licenses from licensing competing technologies.[38] Second, agreements imposing actual or potential restraints on competition that would not otherwise have been there

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CCS Guideline of the Treatment of intellectual Property Rights have no legal force on their own, are non-exhaustive in character, and may be revised by the CCS should the need arise. The Guideline sets out how the CCS views the interface between IPRs and competition law, indicating some of the factors and circumstances which it may consider when assessing agreements and conduct involving intellectual property. The scope of the Guideline is limited to intellectual property rights granted under the Patents Act, Copyright Act, Plant Varieties Protection Act, Layout-Designs of Integrated Circuits Act, and the Registered Designs Act, as well as trade secrets.") Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 20 (2009). ("Following the enactment of the Competition Act, the CCS developed 13 sets of guidelines relating to the implementation and enforcement of the law. These guidelines cover the major aspects of the work of the CCS, such as the three prohibitions, market definition, investigation, enforcement and notification procedures. These guidelines are of particular importance as they clarify the interpretation of the Competition Act by the CCS when competition law is new in Singapore with no precedents.")

[33] Para 3.2 CCS IP Guidelines. Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 404 (Steven D. Anderman ed., 2007). ("The CCS IP Guidelines set out the following general framework for assessing licensing agreements under the section 34 prohibition. Step 1: The nature of the relationship between the parties to the licensing agreement – whether they are competitors or non-competitors – needs to be ascertained. The parties will be treated as being in a competitive relationship if they would have been actual or potential competitors in the absence of the licensing agreement. Step 2: The CCS will consider if the restraints in the licensing agreement restrict actual or potential competition that would have existed in their absence, taking into account their impact on inter-technology and intra-technology competition. Step 3: The pro-competitive benefits of the licensing agreement will be factored into the CCS analysis and weighed against its negative effects on competition. The licensing agreement will nor fall within the scope of the section 34 prohibition, if on balance, it may have a net competitive benefit. This would be the case if the agreement 'contributes to improving production or distribution or promoting technical or economic progress and it does not impose on the undertakings concerned the possibility of eliminating competition in respect of a substantial part of the goods or services in question.')

[34] Para 3.4 CCS IP Guidelines.

[35] See Para 1.2 ("For purposes of these guidelines, the term "intellectual property rights' refers to the rights granted under the Patents Act, Copyright Act, Plant Varieties Protection Act, Layout-designs of Integrated Circuits Act, Registered Designs Act and trade secrets.") and Para. 2.3 CCS IP Guidelines. ("These guidelines address mainly issues relating to technology transfer and innovation.**")**

[36]Paragraph 1.2 of the Guideline and Para.3 of the explanatory policy paper which accompanies it. ("The CCS has indicated that the Guideline is only intended to deal with the competition-related issues concerned with technology transfer and innovation aspects of IPRs. This Guideline is not intended to regulate the product differentiation performed by trademarks and geographical indications. The intellectual property rights statutorily granted under the Trade Marks Act and Geographical Indications Act are therefore not within the scope of this Guideline."")

[37] Para 3.7 CCS IP Guidelines.

[38] Para 3.8 CCS IP Guidelines.

are more likely to be anticompetitive.[39] Third, agreements without countervailing net economic benefits are more likely to be anticompetitive.[40] The Guidelines also state how the CCS will approach the common varieties of licensing clauses including restrictions on independent R&D,[41] grantbacks,[42] territorial and field-of-use restrictions,[43] geographical exclusivity[44] and technology pools[45].

Parties whose market shares fall below *de minimis* levels generally need not be concerned that their agreements will run afoul of competition law. [46] Parties whose market shares exceedthese levels may still be excused if their agreement passes muster under a rule of reason analysis. [47] Agreements that improve production and distribution, facilitate technology transfers and encourage innovation in related markets may be allowed, notwithstanding being tainted by *prima facie* anticompetitive effects.[48] With technology firms increasingly integrating functions in a lattice of horizontal and vertical structures over related markets, the question whether agreements within this corporate structure the economic entity exclusion applies may be a live one.[49] Vertical agreements where the IP licensing restraints are merely ancillary to the agreement, such as franchise agreements, will also be exempted from review.[50] Licenses or assignments of IP, while

[39] Para 3.2 CCS IP Guidelines.
[40] Para 3.2 CCS IP Guidelines. Net economic benefits is read according to para. 9 of the Third Schedule of the Act.
[41] Para 3.22 CCS IP Guidelines.
[42] Para 3.2 CCS IP Guidelines 3. (Stating that direct or indirect restrictions may have anti-competitive effects since they reduce potential competition in technology or innovation markets.)
[43] Para 3.24 CCS IP Guidelines. (Stating that field-of-use or territorial restrictions may promote technology transfer and would be favorably regarded.)
[44] Para 3.25 CCS IP Guidelines. (Stating that territorial exclusivity may provide the incentive to invest in the licensed technology or to develop it.)
[45] Para. 3.26 CCS IP Guidelines. (Technology pools are cross-licensing agreements. Licensing of essential and complementary technologies are regarded as pro-competitive, but may raise competition concerns if they consist of essential or substitute technologies as efficiency gains are reduced and the arrangement may amount to price fixing.)
[46] Para. 3.14 CCS IP Guidelines. (Noting that where the licensing agreement is made between competitors, their aggregate market share should not exceed 25 per cent of any of the relevant markets; where the licensing agreement is made between non-competitors, the market share of each of the parties should not exceed 35 per cent of any of the relevant markets; where it may be difficult to classify the status of the parties to the licensing arrangement as competitors or non-competitors, the 25 per cent threshold will be applied.)
[47] Para. 3.16 CCS Guidelines. Para 10.4 states that there must be a objectively determined direct causal link between the agreement and claimed efficiencies which is of sufficient value to outweigh the anti-competitive effects of the agreement.
[48] Para. 3.2 CCS IP Guidelines. ("The CCS will consider if an agreement that falls within the scope of the section 34 prohibition, may, on balance, have a net economic benefit. An agreement may have a net economic benefit, where it contributes to improving production or distribution or promoting technical or economic progress and it does not impose on the undertakings concerned the possibility of eliminating competition in respect of a substantial part of the goods or services in question.") [Footnotes omitted]
[49] Para. 2.7 CCS Section 34 Guidelines states that section 34 does not apply to entities which form a single economic unit. Richard Whish, *Anti-competitive Agreements*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 75 (2009) ("[S]ince entities in the same economic unit form a single undertaking, it follows that an agreement between those entities is not entered into *between* undertakings.").
[50] Para.3.11 CCS IP Guidelines ("The exclusion covers agreements which concern the purchase or redistribution of products, such as a franchise agreement where the franchisor sells to the franchisee products for resale. This includes

not exempted, are recognized are being pro-competitive.[51] However, bundling or tying agreements will still be scrutinized.[52] In any case, vertical agreements may still be subject to the prohibition against the abuse of dominance where one or more licensing parties are dominant.

Abuse of Dominance: Firms with substantial market power must avoid conduct distorting market competition, either through unilateral or collective exercise of their market power.[53] Market power is assessed in the market for the technology, the market for products and services embodying the technology, as well as markets for research and development.[54] Market power accruing from the IP itself is not objectionable.[55] The CCS IP Guidelines allow even "persistently high" market shares resulting from the owner's use of his IP to deter entry in the short term, as long as competitors may "in the long term be able to enter the market with its own innovation."[56] As Burton Ong observes:

> "This complicates the traditional approach of assessing an undertaking's market power with direct reference to its share of the relevant market. To what extent can an IP-owning undertaking argue that, despite having the sizeable share which has traditionally been used as an indicator for market dominance, it should not be treated as a dominant undertaking simply because its advantages are time-limited by the finite duration of its IPRs?"[57]"

IPR provisions contained in the franchise agreement, such as the trademark and know-how which the franchisor licenses the franchisee in order to market the products.")

[51] CCS IP Guidelines. 3.4 ("IP licensing is viewed as pro-competitive 'in the vast majority of cases' because they lead to more efficient exploitation of the IP, promote innovation by giving incentives to IP owners and reduce transaction costs in some circumstances.")

[52] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 49 (2007) ("Section 34 of the Act prohibits product and service bundling. Bundling occurs when a company conditions the sale of one product or service on the customer's purchase of a second product. This is often known as 'tie' or 'bundle' arrangement.)

[53] Section 47 of the Competition Act. R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 76 (2007) ("The elements that must be proved to find an abuse of a dominant position are: there must be more or more undertakings who are dominant in a relevant market anywhere in the world there must be an abuse of that dominant position which has an effect in Singapore.")

[54] CCS IP Guidelines at para. 2.7. Ng Ee Kia, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 54 (2009). ("According to the CCS, a technology market consists of the intellectual property that is licensed and its close substitutes, that is, technologies that licensees can switch to in response to an increase in the license fee or royalty of the intellectual property…. An innovation market, on the other hand, consists of the research and development ("R&D") directed at bringing about new or improve products and/or better processes, and the close substitutes that could significantly constrain the exercise of market power with respect to that R&D.")

[55] Para. 2.5 of the CCS IP Guidelines. ("The possession of an IPR does not necessarily create market power in itself, as the 'legal' monopoly required for market power to subsist – the latter only arises when there are insufficient actual or potential close substitutes from alternatives supplied by the intellectual property owner's competitors.")

[56] Para. 4.3 of the CCS IP Guidelines. ("(I]n markets where undertakings regularly improve the quality of their products, a persistently high market share may indicate no more than persistently successful innovation. ")

[57] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 408 - 09 (Steven D. Anderman ed., 2007).

Being dominant or maintaining dominance through successful innovation or economies of scale or scope are acceptable. It is only where the IP owner attempts to leverage its IP to extend its market power to the detriment of market competition resulting in a loss of total welfare that the CCS will intervene. [58] This includes predatory behaviour,[59] refusals to license essential IP,[60] and tying arrangements.[61] In justifying their right to exercise the right to exclude conferred by IP, IP owners facing abuse of dominance allegations should be aware of the riposte that the CCS IP Guidelines recognize entry barriers arising from network effects which commonly permeate high technology markets.[62] The CCS IP Guidelines allows high market shares if market power is curtailed by low entry barriers.[63] There is no express prohibition against excessive pricing in Singapore. As Richard Whish notes:

> "This is a sensible position for the CCS to have taken, since it is certainly not the function of a competition authority to establish itself as a price regulator: in competitive markets, it is the market itself that should determine what the price should be.... It may be that the courts in Singapore would interpret the deliberate deviation from the wording of Article [102

[58] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 90 (2007) ("[I]t is important to note that, unlike the US and Australia, there is no need to prove a causal link between being dominant and abuse. So a firm that is dominant in a market does not have to use the market power conferred by that dominance to abuse its position. So the market in which the abuse occurs can be separate from the market in which the firm is dominant."). See also Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 409 (Steven D. Anderman ed., 2007). ("The CCS IP Guidelines suggest that the real competition-related concerns involving the exercise of an IPR by a dominant undertaking arise primarily in situations where 'the dominant undertaking attempts to extend power into a neighbouring or related market, beyond the scope granted by IP law'. This form of leveraging is exemplified in tying arrangements where the dominant undertaking, an IP licensor, imposes a condition on IP licensees that it will only grant licenses if the licensee agrees to buy another product not covered by the IPR... Similarly, a dominant undertaking which occupies a position of market dominance by virtue of its IPR ownership may, in limited circumstances, also engage in abusive conduct if it refuses to license its intellectual property rights. Such conduct might qualify as an abuse of a dominant position if the refusal 'concerns an IPR which relates to an essential facility with the effect of (likely) substantial harm to competition, and where the dominant undertaking is not 'able to justify its conduct'")

[59] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 80 (2007) ("(T)he EU and UK are not only concerned with exclusionary conduct but also with exploitative or unfair conduct. … The Singapore Competition Act on the other hand is primarily concerned with exclusionary conduct…").

[60] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 96 (2007) ("A dominant firm can abuse its dominant position by restricting access to a new technology. For example, the European Commission found that IBM had abused its dominant position by withholding critical information from competition which made it difficult for competitors to offer new IBM-compatible equipment in time to compete with new IBM products. In the Magill case the [European Court of Justice] ordered[ed] television companies, who formerly published their own individual program guides, to supply another company and each other with their copyrighted programming in advance of broadcast.")

[61] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 100 (2007) ("The theory behind the prohibition is that a dominant firm can use its market power in one market to lever that power into another market. ... In the *Microsoft II case,* the European Commission imposed a substantial fine because Microsoft tied its Windows Media Player (where it faced competition) to Windows operating system (a market in which it was dominant). Microsoft was ordered to un-tie the two products and to offer a Windows operating system without Windows Media Player.")

[62] Para 3.12 CCS Guidelines on the Section 47 prohibition.

[63] Para. 3.11 CCS Guidelines on the Section 47 prohibition.

> TFEU] and the Chapter II prohibition in the UK as indicating that exploitatively high prices – simply overcharging customers – are excluded from the Act; however, where an excessive price is simply a different way of achieving the effect of a refusal to supply, it may be more difficult for the CCS to ignore a claim that the price in question is abusive."[64]

An issue that may arise in the context of the abuse cases is the difficulty of defining the relevant geographic market because of Singapore's small, open economy. As Michael Gal notes, by excluding imports, the market power of domestic firms may be artificially high.[65] Getting data on the likelihood of consumers switching to imports and market entry by foreign suppliers, as Ian McEwin notes, may be difficult as a practical matter. [66]

Internal checks and balances within the IP regime sidestep the requirement to measure switching costs and the likelihood of market entry.[67] Consistent with Singapore's liberal trade policy, its IP laws generally encourage parallel imports of genuine goods without the consent of the IP owner. These policies prevent owners from segmenting domestic and overseas markets and promote price competition both through the provision of direct substitutes as well as through the threat of entry by competitors, [68] since "[t]he threat of import competition can constrain a dominant firm, even if there are currently no imports. In fact the dominant firm may be pricing at a level to deter imports."[69]

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[64] Richard Whish, *Anti-competitive Agreements*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 147-8 (2009). (Noting that the absence of an expression prohibition should be understood in the open ended nature wording of Para 11.1 of the CCS Section 47 Guidelines.)

[65] MICHAL S GAL, COMPETITION POLICY FOR SMALL MARKET ECONOMIES 60 (2003) quoted in Ng Ee Kia, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 47 (2009). ("It is important, especially for small economies, to give due consideration as to whether imports should be included when defining the relevant market in order to prevent the market power of domestic firms from being systematically exaggerated.")

[66] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 88 (2007) ("As Singapore is a small open economy open to international trade, defining the geographic market may be problematical at times. For example, it may be difficult to get data on whether consumers will switch purchases outside Singapore or identifying which suppliers outside Singapore are likely to export or otherwise enter Singapore if domestic price is raised.")

[67] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 377-78 (Steven D. Anderman ed., 2007) ("While competition may be used as an instrument to address conduct involving the exercise of intellectual property rights which curtail competition market processes, similar pro-competitive outcomes may also be facilitated from within the law of intellectual property through its internal checks and balances which circumscribe the extent of the right holder's ability to exercise his proprietary rights.")

[68] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 12 (Rev. Ed, 2009) ("In parallel importation, products made by the IP right proprietor (or by his licensee) and put on the market in one country, are lawfully purchased by a trader who then imports them into another country for resale. Parallel importation thrives as a trade usually because of different price structure for the product in different markets/countries. The price of the imported products in the second market/country is usually lower than that of products put onto that market by the IP right proprietor himself or by his licensee. Naturally, the IP right proprietor is opposed to this leakage of products from his lower-priced markets/countries into his higher priced markets/countries.")

[69] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 88 (2007) .

Once a trade mark owner has placed its goods on the market anywhere in the world, or allows their goods to be so sold, his rights are exhausted and can be imported for resale in Singapore in competition with more expensive versions of the same products.[70] Consent is deemed to have been given even if conditions against resale were contractually undertaken by distributors or retailers of those goods.[71] As Loy Wee Loon has rightly argued, trade mark owners should be treated as having enjoyed the first mover advantage conferred by trade mark law, and not be able to hide behind the guise of associated companies to artificially extend its entitlement to create scarcity and hold up prices.[72] Only where the condition of the goods have changed or are defective in a way that harms the reputation or distinctiveness of the trademark can the Singapore owner prevent the sale of those goods. [73]

Copyright and patent laws have similar provisions. [74] In the case of copyright law, copyright owners are also prohibited from using copyright in accessories to prevent imports of products which would otherwise

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[70] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 312 (Rev. Ed, 2009) ("Section 29(1) sets out what is called the principle of *international exhaustion* of the rights in a registered trade mark – the registered proprietor's right in the goods marketed with the registered trade mark are exhausted once the goods are sold anywhere in the world by the registered proprietor or with his consent.")

[71] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 312 (Rev. Ed, 2009) ("…. the proprietor is deemed to have given consent to the sale of the goods even where he has imposed conditions on the further movement of the goods, for example, by restricting sale of the goods to a particularly territory.")

[72] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 312-3 (Rev. Ed, 2009) ("[A] trade mark proprietor should not be allowed to get around the principle of international exhaustion of rights in s29(1) by registering the mark in different countries in the names of different subsidiaries or associated companies. Whatever may be the corporate structure used by the trade mark proprietor in its global marketing strategy, the fact remains that goods are made by any one of the entities within the same corporate structure are made under the control of the trade mark proprietor and to this extent, these goods if imported into Singapore should be regarded as parallel imports for the purposes of s29(1).")

[73] Section 29(2) of the Trade Marks Act. NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 315 (Rev. Ed, 2009). ("Section 29(2) sets out a scenario where the principle of international exhaustion of rights will not apply. This is where 'the condition of the goods has been changed or impaired after they have been put on the market.' The reference to the phrase 'condition of the goods' is probably a reference to the physical condition of the goods found inside the packaging". This means that repackaging of the goods which does not involve any change to the goods themselves ... would not qualify as a change to the 'condition of the goods' for the purposes of s 29(2). ... Section 29(2) applies where the change or impairment to the condition of the goods occurs after the goods have been put on the market. This subsection cannot deal with cases where the quality difference between the imported goods and domestic goods exist before the imported goods were put on the market and is, in fact, a difference introduced by the trade mark proprietor himself.")

[74] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 385 (Steven D. Anderman ed., 2007). ("The net effect of [Section 25 of the Copyright Act] is to make it permissible for persons to import copyright-protected articles into Singapore which have been lawfully made abroad with the consent of the copyright holder, or anyone authorised by him, in the country where the article was made. In other words, as long as the copyright was not violated in the country where the article was manufactured, the article will not be treated as an infringing article if it is brought into Singapore, even if the copyright holder in Singapore is not the importer. This approach eliminates the problem arising from situations where the copyright owner has licensed his copyright to different and independent entities in different jurisdictions. Further.. any conditions placed on the manufacturer of those goods on where the

be permitted.[75] Competitors of pharmaceutical patent owners can manufacture generic versions of the patent drug for regulatory approval to shorten the lag between the patent's expiry and the available of generic substitutes.[76] A more tenuous example is the ability of patients requiring specific drugs which enjoy patent protection in Singapore, but are not locally available to import those drugs. It has been argued that this puts pressure to make those drugs available.[77] However, the patent owner may find it nonetheless more desirable to limit sales in the short term to countries outside Singapore by segmenting markets for profit or other strategic reasons. Parallel import of patents were also narrowed in other respects, allowing owners of

goods can be sold and so forth are disregarded. If, on, the other hand, where the imported articles were made under a compulsory license in the country of manufacture, these articles will probably be considered as having been made without the requisite 'consent' of the relevant copyright holder.") See also NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 418-19 (Rev. Ed, 2009) ("There are three features to note about the principle of exhaustion of patent rights in Singapore. First, importation is permitted even if the proprietor in Singapore is different from the proprietor of the patent in the country of manufacture. … Secondly, … this defence has no application to cases where the infringing act relates to the use of the patented process in Singapore…. Thirdly, any condition imposed by the patentee restricting the resale of the product outside the territory of manufacture/first sale shall be disregarded for the purposes of determining if the product was produced by or with his consent.")

[75] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 385 (Steven D. Anderman ed., 2007). ("The liberal approach towards parallel imports extends to accessories which accompany parallel imports... no copyright infringement arises from the importation or use of accessory articles which accompany non-infringing imported articles. In these circumstances, copyright holders cannot assert their copyright in instruction booklets, packaging, labels, pamphlets, brochures, warranties, manuals or other works ancillary to the main product as a means of keeping parallel imports of the main product from entering the Singapore market.")

[76] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 214-15 (2009) ("The Bolar provision refers to a provision in US patent law allowing third parties to manufacture generic drugs shortly before expiration of the patent for the purposes of obtaining marketing approval for the US market. Rather than forcing the third party to wait until the patent rights have expired, the Bolar provision allows this limited use of the patented drug pre-patent expiry so that the third party can gear up in anticipation of the time when the drug is patent free from protection."). SEE ALSO Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 390 (Steven D. Anderman ed., 2007). ("This facilitates immediate competition between 'branded' drugs manufactured by patent holders and generic versions of these drugs to take place after the 20-year period of exclusivity ends, rather than giving the former a post-patent window period in which they are the sole-suppliers of the drug while generic drug manufacturers are held back by the marketing approval process.")

[77] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 215 (2009). ("The Patents (Amendment) Act 2004 also creates a new provision in section 66(2)(i) covering importation, use and disposal of any pharmaceutical product (made with consent of the patentee) required for the use of a specific patient in Singapore. Thus suppose that a patented drug is available only in US. A patient in Singapore needs the drug for treatment. So long as the drug was made by or with the consent of the patentee or his licensee, it can be imported into Singapore for that patient's use. The relevant authority (Health Science Authority) must grant approval for the use of the product by the patient."). See also Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 390 (Steven D. Anderman ed., 2007). ("The secondary, and perhaps unintended, effect of this defence is the imposition of additional competitive pressures on firms which supply the same patented pharmaceutical products in Singapore. These imported pharmaceutical products may be brought into Singapore as non-infringing articles even if exporting them from their country of origin resulted in a breach of the license conditions under which they were manufactured.")

pharmaceutical patents to prohibit imports made in breach of contract with a foreign licensed distributor where first sale in Singapore had not been made.[78]

Like parallel imports, compulsory licensing offers consumers and downstream technology users access to IP that would otherwise be embargoed by the owner.[79] The Patent Act thus allows the High Court to grant compulsory licenses where it is necessary to remedy an anti-competitive practice. This happens where there is a market for the invention in Singapore, but it is either not being supplied or not being supplied on reasonable terms and patentee has no valid reason for failing to supply the market.[80] It is not clear whether anticompetitive acts that result in failure to supply overseas markets would invoke compulsory licensing powers, the view on this seems that it will be unlikely.[81] Another area of ambiguity is whether compulsory licensing under the Patent Act will be invoked upon a finding of anticompetitive abuse under competition law or whether competition related conduct under patent law encompass broader or distinct considerations.[82] This debate is not limited to Singapore. In the U.S., for example, patent law embraces the doctrine of patent misuse, and an alleged infringer or party unrelated to an infringement action can request that the court prohibit a patent owner from enforcing its patent rights because of misuse. While the view espoused by the penultimate appellate court, the Court of Appeals for the Federal Circuit is that patent misuse is limited to addressing anticompetitive conduct whose analysis is informed by antitrust principles,

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[78] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 389 (Steven D. Anderman ed., 2007). ("The breadth of the defence was reined in by legislative amendments in 2004 which introduced section 66(2A): in response to pressure from the United States, the section 66(2)(g) defence is not available to patented pharmaceutical products when the product has not previously been sold or distributed in Singapore with the consent of the Singapore patent proprietor or his licensee, where the import of the products would result in their being distributed in breach of a contract between the Singapore patent proprietor and a foreign licensed distributor, and where the importer has actual or constructive knowledge of these matter.")

[79] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 379 (Steven D. Anderman ed., 2007) ("The availability of compulsory licences under the various intellectual property regimes also enables third parties to gain access to protected subject matter and, in limited cases, offer consumers an alternative avenue for goods and services which are identical to those supplied by the intellectual property right owner.")

[80] Section 55 of the Patents Act.

[81] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 214 (2009) ("Another point worth a mention is that the former restriction in section 55(4) that the grant of compulsory licences to cases where the need is to supply the patent invention predominantly in Singapore was removed. How this will be interpreted may [be] a matter of some importance. Will the new provisions apply where the allegation concerns an anti-competitive act that affects the ability of Singapore manufacturers to supply an overseas market? This seems unlikely.")

[82] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 214 (2009) ("Does this mean that section 55 is only relevant after the Competition Commission has made a finding that the patentee has behaved in an anti-competition manner? This seems unlikely as there is no mandatory link between anti-competitive behaviour under section 55 and the work of the Competition Commission. And yet, it seems a little odd that the court might take its own view of what an anti-competitive act in respect of patent behaviour when the term 'anti-competitive' has no general definition of meaning in the Patents Act and when the term requires careful appraisal of the exercise of power and market efficiency.")

others have challenged this view as detracting from the view taken by the U.S. Supreme Court which allows non-competition related considerations to invoke the patent misuse defence.[83]

It may fairly be expected that there will be more cases brought under the Patents Act, with the right to private action filtered through the CCS as well as a higher threshold of proof for anticompetitive harm.[84] In Singapore, patent law recognizes that licensors may impose 'tie-up' contracts requiring licensees to continue paying royalties after the patent has expired. These contracts inhibit the dissemination of the patented technology to others who could use it to offer consumers competing products or build upon that technology in related markets. On the application of the licensee, the court may vary the contract to the extent that it has been infected by the post-expiration condition.[85] Another form of anticompetitive agreements are 'tie-in' licenses which requiring licenses to purchase products or services connected to the patented technology in order to be allowed to use that technology. In such instances, courts may not only void the clause, but immunize all infringers from liability until the infected clauses are removed.[86]

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[83] BRUCE D. ABRAMSON, THE SECRET CIRCUIT: THE LITTLE KNOWN COURT WHERE THE RULES OF THE INFORMATION AGE UNFOLD (2007) ("In its decision establishing the patent misuse doctrine, the U.S. Supreme Court did not require a finding of either an antitrust violation or an anticompetitive effect. The Federal Circuit, in its recent decisions, however, has almost uniformly required proof of an anticompetitive effect before the doctrine can be invoked. Those recent decisions cannot be squared with the patent misuse doctrine established by the Supreme Court.") See also DARYL LIM, PATENT MISUSE AND ANTITRUST: AN EMPIRICAL STUDY(2011, forthcoming) (providing empirical data supporting this observation and discussing the role of the Court of Appeals for the Fedeal Circuit in shaping conventional wisdom about patent misuse in U.S. patent law.).

[84] Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 23 (2009). ("The interests of parties who have been harmed by anti-competitive activities are also taken into account by the Competition Act, which provides for third-party rights of private action. However, these parties may seek redress in the courts for the harm they have suffered after the CCS has made a finding of infringement of the Competition Act. This approach allows the harmed parties to seek the relevant compensation while at the same time preventing businesses from being burdened by frivolous claims.")

[85] Section 52 of the Patents Act. NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 402 (Rev. Ed, 2009) ("These contracts are objectionable because they thwart the rationale underlying the patent system – a monopoly is given for a limited period of time to reward the patent proprietor but after the expiry of this period, the invention should fall into the public domain free for all to use and to build on. For this reason, the Patents Act frowns upon an attempt by the patent proprietor to prolong his monopoly over his invention. Therefore, there is specific provision which safeguards the interests of licenses who find themselves in this position. Section 52 allows the licensee of such a contract to terminate the 'tie-up' contract when the patent is no longer in force. Further, the licensee can apply to the High Court under this provision to review any term or condition in this contract on the basis that it would be unjust for him to continue to comply with this term or condition. The court may then vary this term or condition as it thinks just as between the parties.")

[86] Section 51 of the Patents Act. NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 425 (Rev. Ed, 2009). ("Section 51 deals with what are called 'tie in' contracts. These are contractual agreements used by the patentee to tie his licensee, or a person seeking a supply of his patented invention, to acquire things a person seeking a supply of his patent invention ('tie in') from him. Here, the patent proprietor is attempting to extend his monopoly beyond the market for his invention to an adjacent market. The penalty for engaging in such anti-competitive practice is severe. Under s51, not only is this clause void, but the existence of such a contract also provides a defence to any person sued for infringement by the patent proprietor. ")

Mergers: The Competition Act prohibits mergers that substantially lessen competition,[87] and the CCS' Merger Guidelines expressly note that IP is an entry barrier relevant to the analysis.[88] So a merger between two undertakings that consolidates ownership of patents that prevent challenges to their monopoly be may be anticompetitive. In most cases, patents are the source of this anticompetitive effect. One outcome may simply be to block the proposed merger on the basis that the likelihood of concentrating technology which is not readily duplicated in the hands of a single entity would make it likely for it to engage in monopolistic behaviour and unlikely for new entry to challenge that market position.[89] Another outcome would be to allow the merger to proceed, but to require remedial measures to address the anticompetitive effect. For example an undertaking by the new entity to provide non-discriminatory licenses for a reasonable royalty to third parties seeking access to the technology.[90] These compulsory licenses may world-wide, and even on a royalty free basis.[91] In cases where the IP forms but a component of the firms' overall portfolio such licenses may be treated as routine steps in the merger review process. However, careful thought should be given before imposing compulsory licensing obligations on firms whose entire asset base is made up of IP. This may amount, in effect, to a state-sanctioned divestiture of the undertaking's key strategic assets to competitors and in doing so, undermine both the incentives put in place by the IP regime as well as sever the synergies inherent in an integrated firm structure.

B. *Policy*

The Singapore government is mindful that competition law imposes compliance costs, and will likely be cautious in regulating the exploitation of IPRs.[92] Singapore's ability to propel its economy in 30 years from simple manufacture and unskilled labour, to one with a high degree of sophistication in life sciences and biomedical sciences has been the product not only of long-range planning facilitated by the current

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[87] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 166 (2007) ("History has shown us that dominant firms in a given market can and do often abuse their dominance and financial might by snapping up would-be competitors and libraries of intellectual property to halt the commercialization of technology that may hurt their dominance.")

[88] Para. 7.6 CCS Guidelines on the Substantive Assessment of Mergers.

[89] Federal Trade Commission, 'FTC Challenges Thoratec's Proposed Acquisition of HeartWare International', July 30, 2009. www.ftc.gov/opa/2009/07/thoratec.shtm

[90] See e.g. Boston Scientific's Acquisition of Cardiovascular Imaging Systems (March 9, 1995), West Publishing citations to court opinions (July 5, 1995) and Ciba-Geigy/Sandoz Ltd Merger U.S. v. 3D Systems (January 3, 2001) www.cptech.org/ip/health/cl/us-at.html See also Para. 9.7 CCS Merger Guidelines (Mentioning "an amendment to intellectual property licenses" as a possible remedy.)

[91] *US v. Halliburton Company* (where the "DOJ alleged that the merger of Halliburton and Dresser would combine two of the four companies that were developing drilling tools for oil and natural gas projects and their merger would likely lead to "a slowdown in the pace of ... innovation."')

[92] Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 10 (2009). ("The Singapore government recognized that there is a need to balance regulatory and business compliance costs against the benefits from effective competition.")

administration's durability but also the government's ability to convince its people of the merits of respecting IPRs.[93]Singapore leads the Asia-Pacific in its multilateral commitments to ever higher minimum standards of IP protection, and committed ourselves to bilateral Free Trade Agreements such as those with the United States which surpass its multilateral obligations. [94] Today, Singapore has been held up as an IP haven in Asia, with more than 7,000 multinationals. [95] The World Intellectual Property Organization ("WIPO") chose Singapore as its hub for alternative dispute resolution. The 2009 World Competitiveness Report of the World Economic Forum ranked Singapore in overall third position with a first position for intellectual property protection.[96]

Reinforcing this commitment to ensuring returns on IP investments is Singapore's status as an export oriented economy, highly dependent on international trade and foreign investments.[97] Singapore sits at heart of Asia-Pacific and is the gateway to East and West. Unlike many developing countries past and present,

[93] Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 250 (Paul Goldstein and Joseph Straus ed., 2009) ("Singapore's ability to successfully implement IP protection is tied to Singapore's unique cultural and political landscape. The country enjoys a high level of respect for the rule of law and low rates of corruption. The public perception towards IP is generally favourable.... Another reason Singapore has been able to accomplish long-range objectives is Singapore's exceptional political stability. The People's Action Party (PAP) has been the ruling party since the beginning of nationhood (1965), and it enjoys an overwhelming majority: there are only two opposition members in the entire 84-member Parliament. This consistent majority means that legislators can take a long-term approach, and also that the process of lawmaking is relatively efficient.")

[94] Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 233 (Paul Goldstein and Joseph Straus ed., 2009) ("On the IP front, [Singapore's] legal regime of protection is "TRIPS-plus"…."), REPORT OF THE ECONOMIC REVIEW COMMITTEE OF SINGAPORE (2003) 52 ("We will continue to support the World Trade Organization (WTO) as it remains the foundation for world trade, and protects small countries like Singapore against unfair unilateral trade practices. However, a purely multilateral approach has its limitations. We are therefore supplementing it with bilateral FTAs with key trading partners.")

[95] Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 234, 235 (Paul Goldstein and Joseph Straus ed., 2009) ("… Singapore's rapid technological development and industralisation programme is heavily dependent on MNCs rather than on indigenous firms…. The strategy was to embark on an industralisation program that was export-oriented. Foreign investors were actively wooed to develop their manufacturing operations in Singapore for export to the world markets – both in low-technology, labour-intensive technologies … and in higher-technology industries. The electronics sector began during these early years with American MNCs setting up in Singapore: Texas Instruments in 1968, National Semiconductor in 1969, Hewlett Packard in 1970 etc.") Note, however, NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 50-51 (Rev. Ed, 2009) ("It would be very naïve, though, to attribute Singapore's success in attracting FDI solely or primarily on its strong IP infrastructure…. A strong IP infrastructure is a very important, but certainly not a sufficient factor to pull in FDI. If it were otherwise, China with its problematic track record in IP enforcement would have attracted far less FDI.")

[96] www.weforum.org/documents/GCR09/index.html

[97] R IAN MCEWIN, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 5 (2007) ("Singapore is a relatively small economy but open to international competition. What does this mean for competition law? … (I)nternational trade increases the size of market demand and so in open economics, in order to compete internationally, firms must be of a sufficient size to compete on export markets and with imports. So firms that would be too small in a closed economy reach efficient size through exporting. ")

Singapore regarded foreign MNC as a boon to national development.[98] MNCs have also played a critical role in technology transfer and who would be most affected by IP-oriented competition enforcement. The Economic Strategy Committee reaffirmed in 2009 that:

> "Singapore should entrench its position as a location of choice for the world's leading companies, including MNCs, global mid-sized industry leaders, and Asian enterprises seeking to internationalise. MNCs must remain key players in our economy. They are a major source of new technologies, and allow Singapore to stay plugged into the developed country markets – which although slow growing, will remain sizeable sources of sophisticated demand."[99]

As a result, while Singapore's competition policy may mirror those in the EU and US in many ways, it can be expected to diverge where foreign precedents are inconsistent with local policy interests, as commentators such Bruce Owens have noted. [100] Indeed, the CCS itself has declared that:

> "The Commission notes that competition law is a new area of law in Singapore. While some of the [EC and US] cases cited in this decision may be persuasive or useful in assisting the Commission in reaching this decision on the single economic entity argument, they are not binding, The value of any foreign competition case law will depend very much

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[98] LEE KUAN YEW, FROM THIRD WORLD TO FIRST: THE SINGAPORE STORY (1965-2000) 76, 85-86 ("If MNCs could give our workers employment and teach them technical and engineering skills and management knowhow, we should bring in the MNCs … We did not have a group of ready-made entrepreneurs such as Hong Kong gained in the Chinese industrialists and bankers who came fleeing from Shanghai, Canton and other cities when the communists took over [China]. Had we waited for our traders to learn to be industrialists, we would have starved. It is absurd for critics to suggest in the 1990s that had we grown our own entrepreneurs we would have been less at the mercy of the rootless MNCs.")

[99] Economic Strategies Committee, Key Recommendations 23 (Feb 1, 2010) www.esc.gov.sg/attactments/ESC%20Report%201%20Feb%202010.pdf

[100] Bruce Owen, *Imported Antitrust* in John M Olin Program in Law and Economics Working Paper No 281, March 2004, pp 12-13 (Stanford Law School). ("While US federal antitrust enforcement policy is now largely welfare-oriented, it is oriented toward the welfare of domestic consumers. It is ambivalent at best toward domestic producer welfare and it is largely antagonistic to the economic welfare of foreign consumers.... For this and other reasons, the adoption of domestic consumer welfare as the sole objective of competition policy in every nation on the globe clearly is incompatible with global welfare optimism because such policies fail to internalise economic effects that spill over national borders. [footnotes omitted]"). Cavinder Bull, *Preface* in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) ix (2009). ("In the meantime there will be a natural reliance on cases from other jurisdictions, in particular the European Union and the United Kingdom. American case law may also prove to be significant. However, one cannot assume that the CCS will follow a particular case or practice from mature competition law jurisdictions. While Singapore will typically borrow from the lessons and wisdom of other jurisdictions, it will also have to chart its own course as competition law is applied to its own unique situation and economic circumstances."). See also Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 375 (Steven D. Anderman ed., 2007) ("Despite the strong influence of UK laws on the domestic legislative framework which Singapore has enacted, a number of substantive modifications have been made by the legislature to further specific policy objectives which reflect domestic commercial and socio-economic conditions. Singapore has a small domestic market of less than 4 million consumers, but a relatively large, open and export oriented economy.")

> on the overall context and the extent to which the facts of these cases are applicable to the local context and the facts of the present application by the Parties."[101]

Singapore has firmly committed itself to providing robust IP rights to maintain its attractiveness to foreign IP-related investors,[102] as well as tap into the wellspring of the technology transfer process.[103] With this knowhow, Singapore pushed itself up the value chain from manufacturing to high technology and into R&D intensive industries where IP protection remains, in a self-reinforcing cycle, at the forefront of economic policy.[104] To impose robust scrutiny on IP conduct under its competition law would unravel these carefully cultivated efforts.[105]

The question that arises is how the overlay of competition law, which necessarily restricts the commercial freedom over and above the IP laws, would affect Singapore's competition policy with respect to IP rights. In this regard, Burton Ong makes the observation that:

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[101] Qantas & Orangestar Co-operation Agreement CCS 400/003/06 (10 January 2007) at para 28, available at app.ccs.gov.sg/public_reg_Notified_agreement_Qantas_Orangestar_Agreement.aspx.

[102] Second Reading of the Patent Bill 1994 (March 21, 1993 Hansard vol. 62, col 1445) (March 21, 1994). ("[W]e live in a global economy where trade is driven by desire, potential for profit, which in turn is determined by the element of competitiveness. Inventions and innovations sharpen this competitive edge. More countries are therefore improving their industrial property systems, particularly their patent systems to encourage invention and innovation, and to assist in the recoupment of continuing investment costs for development of products and services.")

[103] Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 240 (Paul Goldstein and Joseph Straus ed., 2009) ("The idea behind the strategy to deepen the technology base in Singapore was to move Singapore up the value-chain in manufacturing, especially in emerging fields. The policy-makers firmly believed that a solid IP infrastructure, particularly a sound patent system, was needed to achieve this goal. ")

[104] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 6 (2009) ("Strong intellectual property protection is a core component of Singapore's economic and industrial strategy for her next stage of growth. … Singapore's progress in information technology is well known and few will doubt the resolve to maintain that progress and to develop other areas of "creative" industry such as design and the performing arts."). See also Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 241 (Paul Goldstein and Joseph Straus ed., 2009) ("To maintain Singapore's competitiveness in this new millennium the current phase of economic planning is to work toward graduating Singapore into a 'knowledge-based, innovation driven economy.'").

[105] As Burton Ong observes: "... exogenous derogations from the legal monopoly which IP owners receive from the law of intellectual property would probably not occur in too many cases, given that those who administer Singapore's competition law framework have emphasised that the incentive-reward functions of the law of intellectual property should not be unnecessarily disrupted by the legal uncertainties that would result." Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 401 (Steven D. Anderman ed., 2007); see also Speech By Mr Tharman Shanmugaratnam, Minister For Finance, At Parliament Session, 28 May 2009, 1:30 Pm At Parliament ("Temasek, like GIC, takes very seriously every decline in the value of its portfolio, or in the value of its individual investments. But it will have to keep to its discipline – of being prepared to take calculated risks on individual investments, maintaining a diversified portfolio, rebalancing its investments when necessary to optimize the risk-return profile of the portfolio, and keeping its sights on achieving long term returns. That is how Temasek has operated successfully over the last 6 years, making good gains in its portfolio, and it is how it will seek to deliver good returns over the long term.")

> "The basic objectives of the Commission in this respect are no different from those which inform its more experienced counterparts. The ultimate goal is to adopt a competition policy which strikes an optimal balance between, on the one hand, the incentives for innovation generated by the availability of intellectual property rights against, on the other hand, the exclusionary effects which these limited legal monopolies have on competition and further innovation by third parties."[106]"

The Competition Act incorporates features which recognize the expertise of sectoral regulation in dealing with anti-competitive effects arising from commercial activity in those sectors.[107] Some commentators have suggested that IP law and policy will inform the enforcement of competition law at the Interface in a similar fashion, [108] and it is possible that the CCS will be primarily responsible for the oversight of anti-competitive exploitation of IPRs with guiding input from the Intellectual Property Office of Singapore. This would be a sensible approach. Enforcement of competition law done with an informed appreciation of the nature and scope of the internal checks and balances underlying the IP regime and the IP policies animating the law will a major step forward in getting the balance right.

Singapore's policy toward IP is strongly utilitarian.[109] IP rights are not granted to gratify a creator's moral claims over his creation, or even to reward IP owners as an end in itself. Instead, the goal is to foster creativity, innovation or entrepreneurship which builds upon what has been developed for the betterment

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[106] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 376-7 (Steven D. Anderman ed., 2007).

[107] Cavinder Bull, *Competition Policy and Law*, in COMPETITION LAW AND POLICY IN SINGAPORE (Cavinder Bull and Lim Chong Kin, eds,) 11 (2009). ("In addition, certain exclusions from sections 34, 47 and 54 are set out in the Third and Fourth Schedule to the Competition Act. A number of the exclusions relate to activities in sectors that have recently been liberalized, and are in transition to a more competitive market environment. There are considerable technical matters affecting competition in these sectors and as such, sectoral regulators, with their industry knowledge and expertise, are deemed to be better positioned to address and balance competition goals with other policy concerns.")

[108] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 395 (Steven D. Anderman ed., 2007). ("It is interesting to note that the legislature chose to vest the function of determining when a compulsory license is an appropriate remedy to the court – rather than the competition regulator, the Competition Commission of Singapore – and *to internalise compulsory licensing as one of the features of the patent law system rather than delegating this remedial device to those responsible for administering the competition law regime*.) (emphasis added) and FN 76 ("In contrast, the compulsory licensing under the UK Patents Act 1977 is a lot broader, and more complex as a result, in that it permits compulsory licenses to be sought on competition-related grounds … and non-competition related grounds."). See also NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 426-7 (Rev. Ed, 2009). ("... in determining whether the exercise of a patent right by the proprietor is anti-competitive or not under the Competition Act, the CCS may defer to the guidance provided by the provisions in the Patents Act targeted at anti-competitive behaviour (ss 51, 52 and 55). If that is the case, it means that the extent of 'external' control of the patent proprietor's behaviour under the Competition Act would not be very different from the 'internal controls' provided for in the Patents Act").

[109] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 14 (2009) ("Singapore clearly strongly subscribes to the utilitarian justification for strong intellectual property protection.").

of Singapore in the technological, social and economic sense.[110] The temporary monopoly given to owners to control and commercialize their IP is therefore, at least notionally, calibrated to the level that is sufficient to induce his participation in this endeavour while providing competitors the ability to build upon the IP owner's contribution and, in time, compete with the IP owner. As Burton Ong notes, pro-competitive policy levers within IP law "confine the exclusive rights enjoyed by the intellectual property owner to subject matter within reasonable limits, seeking at the same time to make it possible for his rivals to offer consumers competing, alternative products and services."[111] To this end, a number of layers of internal checks and balances have been woven into the fabric of Singapore's IP laws.[112]

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[110] NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE 355 (Rev. Ed, 2009) ("Like copyright, the aim of the patent regime is not just about providing an incentive to the individual inventor/company. The other aim is to use the patent system to encourage investors to add their new and inventive findings to the common pool of technological knowledge that can be used, and improved upon by other inventors. That is why the patent monopoly, just like the copyright monopoly, has a limited duration. In the case of the patent, it generally lasts for 20 years from the date of filing the patent application.")

[111] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 378-79 (Steven D. Anderman ed., 2007)

[112] A number of examples may be given. First, boundaries between the various species of IP rights serve as the first line of defence to limit the rights of IP owners in favour of market competition. The boundary between copyright law and patent law draws the line between protecting expressions and protecting ideas. The boundary between patent law and trademark law draws the line between protecting functional aspects of products and protecting distinctive aspects of products. The boundary between copyright and trademark law similarly draws the line between protecting a sign as a form of creative expression and a sign as an indicator of source. The boundary between copyright law and the law of registered designs draws the line between protecting the copyright owner's rights in his two dimensional images and protecting ability of competitors to offer substitutes for three-dimensional works which embody those two dimensional designs. The second layer of anticompetitive checks and balances restraining the ability of IP owners to distort market competition exists within each IP right. Each species of IP is an ecosystem that attempts to balance competing interests by calibrating the scope and length of protection in line with the specific goals of each ecosystem, as well as in relation to the other species of IPRs. Patents, for example, protect ideas, the raw material needed for innovation and competition. The requirements are therefore higher than for other IP rights. Patents must be novel with respect to prior art world-wide, inventive and capable of industrial application. Applicants must also disclose and support claims as broad as their desired legal monopoly, so that a person ordinarily skilled in the field of endeavour can work the invention. This makes the invention accessible for public benefit once the patent monopoly expires. Third, exceptions and defences respectively carve out categories of conduct that do not fall within the scope of the IP owner's exclusionary right to begin with, or which excuse otherwise infringing activity from liability. An example is the defence of fair dealing under copyright law. Fair dealing is available to all types of copyrighted works and is a complete defence to allegations of infringement, incorporating concept of 'fair use' from United States jurisprudence. Courts in the United States have interpreted fair use to include even commercial use as long as the use is transformative. See *Sony Corporation of America et al. v. Universal City Studios, Inc., et al.* 104 S. Ct. 774 (1984). If courts in Singapore here take the same approach, there will be greater leeway in developing substitutes and derivative works. Copyright also allows reverse engineering of software so that downstream competitors and independent are allowed to reproduce copyrightable code to uncover interface information required to offer interoperable in ancillary markets. For a discussion of these internal checks and balances, see generally NG-LOY WEE LOON, LAW OF INTELLECTUAL PROPERTY OF SINGAPORE (Rev. Ed, 2009), Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 378-79 (Steven D. Anderman ed., 2007) and GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN (2009)

As IP rights expand, however, their potential for anti-competitive externalities increase. For example, copyright has expanded to protect more functional subject matter such as software and databases. The underlying source code may be near impossible to reverse engineer or license fees may be prohibitively expensive.[113] Database owners may similarly refuse to license competitors in secondary markets.[114] As a result, competitors may therefore be excluded from the market or forced to compete with a severe disadvantage. George Wei has raised concerns that the expansion of IP rights may eviscerate defences and exceptions built into the IP regime to check precisely these negative externalities:

> "Then there are those who argue that even existing exceptions and limitations in copyright law such as fair dealing or fair use type exceptions will count for nothing in the digital world if electronic works are subject to copy-protection that prevents all unauthorized access: even when the copying may fall within fair dealing/use exceptions. Not only is there a threat that technology may render the exception worthless, the technological restraints are now backed up by fearsome laws forbidding the sale or use of counter-technology. Contractual terms may also be used by copyright owners in attempts to circumvent statutory exceptions and the like."[115]

But the upward march of copyright may be inevitable:

> "There is no retreat from the growth of copyright over functional works. Business needs shape the law. As economies become more technology dependent, the case for exclusive rights in database and software industries will be more compelling. To reduce the commercial risks from misappropriation in already risky ventures, businesses appreciate and, in some cases, demand the security that copyright provides in safeguarding their investments. This is not ideal, as it trades one form of risk for another—the risk that information gets balkanised by copyright owners controlling access to interface information or raw data."[116]

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[113] See Daryl Lim, *Beyond Microsoft: Intellectual Property, Peer Production and the Law's Concern with Market Dominance*, 18 Fordham Intell. Prop. Media & Ent. L.J. 291 (2008)

[114] See e.g. *Nine Network Australia Pty Limited v IceTV Pty Limited* [2009] HCA 14 (Where the High Court of Australia found no infringement of copyright in television program schedule because mere effort was not sufficient to qualify for protection); *Lotus Development Corporation v. Borland International, Inc.,* 516 U.S. 233 (1996), (Establishing a distinction in copyright law between the interface of a software product (which is protected) and its implementation (which is not protected).). See also Daryl Lim, *Re-Defining The Rights And Responsibilities Of Database Owners Under Competition Law* (2006) 18 SAcLJ 418 (Examining the applicability and effect of competition law to databases in Singapore.)

[115] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 19 (2009)

[116] Daryl Lim, *Copyright Under Siege: An Economic Analysis of the Essential Facilities Doctrine and the Compulsory Licensing of Copyrighted Works*, 17 ALB L.J. SCI. & TECH. 481, 555-56.

Similarly, patent rights may extend to genes,[117] business methods[118] or basic research tools[119] which block the arteries of commerce and innovation. The narrowing of the right of the public and competitors to IP-related content has been a constant feature in IP policy debates. Where such debates reach an impasse between those favouring stronger IP rights and those favouring weaker rights, competition law can, in appropriate cases, help refocus the debate on market effects in terms of price and visible competition rather than arguments between competitors hinged on speculative threats to innovation incentives. Exacerbating the controversy in recent years are two of the most serious challenges facing Interface policy in the US and the EU today. These are patent hold-ups in standard setting in the IT industry, and brand name drug companies paying off generic drug companies in the pharmaceutical industry to stay out of their markets. Both are key industries for Singapore, and she may soon have to confront the same difficult issues herself.

Standard setting, even amongst competitors, is recognized as generally pro-competitive because they allow the selection and establishment of a uniform technology denominator which reduces transactions costs and promotes the roll-out of offspring technology.[120] However, the standard setting process has been hijacked by firms who lure the standard setting organizations ("**SSOs**") into adopting the standard, either through failure to disclose relevant patents or reneging on assurances that the technology will be licensed on reasonable and non-discriminatory terms. In doing so, they 'hold-up' users of the technology for supernormal profits. There is a great controversy whether and to what extent these patent owners are entitled to those profits, and whether remedying the situation by patent law, competition law or through more SSO oversight may in fact exacerbate the problem by imposing heavy diligence burdens on firms who may end up being deterred in participating in the standard setting process altogether. [121]

At the core of the reverse payments problem is that pharmaceutical consumers are denied access to cheaper drugs because patent owners are paying off potential competitors to delay the introduction of substitutes

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[117] See e.g. *n re Deuel*, 51 F.3d 1552, 1557 (Fed. Cir. 1995) (holding that DNA sequences can be "new chemical entities" in structural terms). But see *Association for Molecular Pathology v. USPTO*, Case No. 09 Civ. 4515, (S.D.N.Y. Mar. 29, 2010) (holding that isolated gene sequences and diagnostic methods using such gene sequences are not patentable subject matter.)

[118] See e.g. *Bilski v. Kappos* 130 S.Ct. 3218 (2010) (affirming that business methods are patentable subject matter).

[119] Robin Feldman, *The Open Source Biotechnology Movement: Is it Patent Misuse?* 6 MINN. J. LAW SCIENCE & TECH. 1 (2004)

[120] R IAN MCEWIN *ET AL*, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 48-9 (2007) ("An agreement on technical or design standards may lead to an improvement in production by reducing costs or raising quality, or it may promote technical or economic progress by reducing waste and consumers' search costs. The agreement may, however, have an appreciable adverse effect on competition in particular, if it includes restrictions on what the parties may produce or is, in effect, a means of limiting competition from other sources, for example by raising entry barriers. Standardisation agreements which prevent the parties from developing alternative standards or products that do not comply with the agreed standard may also have an appreciable adverse effect on competition.")

[121] Daryl Lim, *Misconduct in Standard Setting: The Case for Patent Misuse* (Forthcoming, 2010)

beyond the expiration date of patents covering 'blockbuster' drugs. U.S. cases have held that the exclusive right granted under patent law enables patentees to settle their infringement suits on terms that stop competitive products that infringe. Anticompetitive effects of these settlements are within the exclusionary scope of the patent and are therefore allowed under antitrust law.[122] In the US, other means of introducing cheaper substitutes, such as authorized generics and approved biologics also face challenges in their introduction.[123]

The Interface is evolving landscape, rapidly expanding over subject matter and geography even as technology and business strategies change. Within a brief decade, EU competition law has been confronted by the challenge of devising a legal answer to broadcast companies refusing to license their TV listings, to software companies refusing to license application programming interface information in Europe. Within half that time, it now must address the competition challenges raised by the worldwide digitization of books[124] and global technology mergers.[125] While jurisprudence at the Interface faced its share of teething problems moving through the first generation of cases, moving from the first generation of the Interface to the second generation will be more complicated – many devices are multifunctional and integrated, and the geopolitics of technology and globalization can make national enforcement a dicey international affair.[126]

The first Interface case in Singapore will likely be technically demanding and politically sensitive. Because of its push for foreign technology giants, the potential defendants in competition law cases will likely be sophisticated and well-funded, and the CCS should expect more push back compared to early price-fixing

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[122] See e.g. *Arkansas Carpenters Health and Welfare Fund v. Bayer AG* (*In re Ciprofloxacin Antitrust Litigation*) 604 F.3d 98 (2d Cir, 2010) *en banc* hearing denied 625 F.3d 779 (2010). The size of the payment in the *Cipro* case, however, is larger than the projections of the amount the generic would have made if it won the lawsuit and entered the market and is evidence that the parties may have entered into the agreement even though they believed the patent was invalid. The decision attracted a number of amici briefs requesting an *en banc* review including one filed on behalf of 86 law professors, as well as others by 39 attorney generals, the Federal Trade Commission, and the Department of Justice.

[123] Tom Rosch, *Pay-for-Delay Settlements, Authorized Generics, and Follow-on Biologics: Thoughts on the How Competition Law Can Best Protect Consumer Welfare in the Pharmaceutical Context*, Remarks at the World Generic Medicine Congress Washington, D.C. (November 19, 2009). Available at www.ftc.gov/speeches/rosch/091119worldgenerics.pdf

[124] Ian Traynor, 'Brussels tries to fight Google book plan by overhauling EU copyright law' The Guardian UK, (7 September 2009) www.guardian.co.uk/business/2009/sep/07/brussels-google-copyright-law-campaign. For a US perspective, see Lalit K Jha New Google book settlement still raises antitrust concerns: US February 5, 2010**,** www.business-standard.com/india/news/new-google-book-settlement-still-raises-antitrust-concerns-us/85033/on

[125] Paul McDougall, Oracle Sun Merger Wins EU Approval, InformationWeek, January 21, 2010, www.informationweek.com/news/government/enterprise-apps/showArticle.jhtml?articleID=222400062

[126] US Department of Justice, Assistant Attorney General for Antitrust, Thomas O. Barnett, Issues Statement On European Microsoft Decision (September 17, 2007) www.justice.gov/atr/public/press_releases/2007/226070.htm ("We are, however, concerned that the standard applied to unilateral conduct by the CFI, rather than helping consumers, may have the unfortunate consequence of harming consumers by chilling innovation and discouraging competition")

cases where the defendants were found with clear and convincing evidence of their infringement.[127] But if done well, businesses will know what can be done and what has to be accepted, and Singapore can benefit from clear and well-reasoned enforcement at the Interface. Because IP is territorial, and businesses and foreign investments are mobile, the Interface is a zero-sum game between countries. And the country that gets it right will have a feather in its cap. [128] How then should Singapore proceed?

To develop a sophisticated approach to dynamic efficiency considerations, the debate needs first to be informed by more empirical evidence to find out what is really happening on the ground in Singapore. The IP Academy, a think tank in Singapore, did a study on the economic contribution of copyright-based industries in Singapore.[129] This is a step in the right direction. International organizations such as the World Intellectual Property Organization and the International Competition Network can be valuable resources to better understand the intricacies of the Interface.

Second, the choice of laws and synergy between relevant institutions need to be considered. The CCS prudently focused its early enforcement efforts on 'hardcore' infringements of competition law– price fixing agreements, in sectors with limited potential for spill over, while carefully defining and expanding the corpus of articulated competition policy decisions. In later higher stakes litigation, these early cases will be a valuable guide to the public. A significant challenge, as Burton Ong notes, is to determine how exactly IP related cases differ from the precedents sent in place by separately developing non-IP case law. [130] The CCS and courts will have to determine how to approach the various branches of IP, each which has different

[127] e.g. CCS Fines 16 Coach Operators and Association $1.69 Million For Price-Fixing (3 November 2009) app.ccs.gov.sg/cms/user_documents/main/pdf/EBAAPressrelease031109.pdf CCS fines pest control operators for bid-rigging app.ccs.gov.sg/cms/user_documents/main/pdf/ID_030108WoodstockCCSRegister.pdf (9 January 2008)

[128] www.ipacademy.com.sg/section/aboutus/history.html. ("The value of IP cannot be underestimated. With globalization and rapid technological advancements, IP will continue to increase in strategic importance against traditional advantages such as geographical location and abundance of natural resources. Those who are able to maximize their intellectual assets will have a clear advantage.")

[129] GEORGE WEI, SOME THOUGHTS ON INTELLECTUAL PROPERTY RIGHT: A MONOGRAPH FOR GERALD DWORKIN 6 (2009) ("One of the first research exercises carried out by the IP Academy was in fact a study on the economic contribution of copyright-based industries in Singapore. Using the WIPO classification framework for creative industries, the 2004 Report strongly supported the positive impact made by Singapore's copyright-based industries to the nation's economy The preliminary findings indicated that in 2001, copyright-based industries generated "approximately $8.6 billion in value added" representing some 5.6% of Singapore's GDP.")

[130] Burton Ong, *The Interface between Intellectual Property Law and Competition Law in Singapore*, in THE INTERFACE BETWEEN INTELLECTUAL PROPERTY RIGHTS AND COMPETITION POLICY 401-02 (Steven D. Anderman ed., 2007). ("The challenge ahead for the Competition Commission of Singapore (CCS) is to fit IP-related instances of commercial conduct which raise competition related concerns within the general competition law framework, while administering block exemption schemes for those transactions which are recognised to be pro-competitive on the whole. One of the more contentious issues here is the extent to which IP-related transactions or commercial conduct should be differentiated from similar situations involving non-IP proprietary interests when brought under the scrutiny of competition law, bearing in mind the special policy considerations which underline the various intellectual property systems and the internal checks and balances that exist within each of them.")

checks and balances and are guided by different policy considerations. [131] The CCS IP Guidelines expressly recognize that while both categories of cases share common characteristics, IP is costly to develop and susceptible to free-riding. [132] Enforcement based on policy purporting to promote innovation can be a speculative enterprise, and the different considerations undergirding the various sectors of IP industries make enforcement of competition law a considerably more challenging task than in 'brick-and-mortar' industries.

The combination of Singapore's relatively small jurisdiction and the right private action allowed only after the CCS has itself decided to proceed against potential offenders conspires to make any cases at the Interface few and far between. But even such cases do come before the courts, they may not be the best forum to seek remedy the problem because of the fast moving nature of technology industries. As Frank Easterbrook put it:

> "Competition is the long-run solution to monopoly. Perhaps antitrust law speeds up the arrival of the long run. Perhaps it does not. Unless we know it does, judges ought to apply their talents in other fields, where they have a comparative advantage over other institutions. ... For the law to have a comparative advantage, legal processes must be able to beat market processes to a conclusion in assessing novel business practices... If rivals will undo a monopoly or evade a questionable practice before judges can decide the case, there is little point in incurring the costs of litigation and suffering the inevitable mistaken judgments."[133]

The higher cost of litigation inherent in requiring expert economic witnesses in competition litigation, rather than resolving those issues as part of patent infringement suit, which though costly would be more streamlined and relatively cheaper. Courts, parties and institutions in Singapore are more familiar with IP laws and commercial certainty is aided by a considerable corpus of case law, policy statements and detailed legislation. Falling back directly upon IP policy as a first line of defense to calibrate intervention makes the

[131] Para. 2.4. CCS IP Guidelines. ("Although there are clear and important differences in the purpose, extent and duration of protection provided under the IP regimes mentioned in paragraph 1.2, the general analytical principles to be applied are the same.")
[132] Para. 2.2 CCS IP Guidelines. ("IP has certain characteristics that may make it difficult for IP owners to restrict access to, and therefore, exercise their rights over it. For example, IP is costly to develop, but often easy and inexpensive to copy, thus making it difficult to prevent others from free-riding on the discovery in the absence of IP law. The use of IP is also typically non-rivalrous, meaning that one person's use does not reduce its use by another person. While these characteristics will be taken into account in competition analysis, they do not warrant the application of fundamentally different analytical principles to IPRs.")
[133] Frank H Easterbrook*, Comment: Comparative Advantage and Antitrust Law* 75 Calif. L. Rev 983 at 985.

outcome more sensitive to innovation considerations as well as attenuates the negative effect of false positives, since the remedies under the IP laws are generally less drastic than under competition law.[134]

To succeed in this enterprise, it is crucial to develop the correct competition culture. This involves retaining a core group of competent people, not just in the CCS but in the private sector as well, since Singapore's laws develop in an adversarial way.[135] Also need to develop the right synergy between lawyers and economists. As Ian McEwin noted, lawyers reason from case to case and draw principles from there - they think from small to big.[136] In contrast, economists work from theories based on assumptions to explain results in specific cases, so they think from big to small, and sometimes two minds do not meet. However,

> "At the same time, the complexity of competition economics should not be exaggerated. There is much common sense involved in economic analyses based on sound methodologies. The focus on economic insights should not be confused with applying complex, mathematical formulas and/or econometrical calculation models in competition assessment. The strength of economics lies in econometric analysis. This means that economists should try to help "de-esoterise" market effects of [IP] and competition law…. (but) [c]ompetition policy should not retreat to purely econometric standards in its attempt to use scientific means to resolve or mask what is an inherently normative dispute requiring a measure of "hunch, faith and intuition.""[137]

IV. CONCLUSION

Singapore is not yet an innovation driven economy, but it is in the process of transition toward one. In many instances, firms locate in Singapore due to its traditional strengths such as the business friendly environment; its location and openness to immigration; its multicultural society etc. and not because Singapore has a 'creative' workforce. Most of the private research and development expenditure is focused

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[134] IP remedies generally consist of injunctions and restitutionary damages. In contrast, punitive fines generally have accompanied orders to modify the offending license or cease the offending activity in more mature competition jurisdictions. Section 69(4) of the Competition Act allows the CCS to impose a fine of up to 10% of the turnover in Singapore for each year of infringement, for up to three years if it is satisfied that the breach was either negligent or intentional.

[135] Daryl Lim, *Copyright Under Siege: An Economic Analysis of the Essential Facilities Doctrine and the Compulsory Licensing of Copyrighted Works*, 17 ALB L.J. SCI. & TECH. 481.

[136] R IAN MCEWIN, COMPETITION LAW IN SINGAPORE: PRINCIPLES, PRACTICE AND PROCEDURE 6-7 (2007) ("Common law lawyers often argue by analogy. This means focusing on particular facts and then developing the principles. … Economists on the other hand, use deductive reasoning (that is, top-down). Economists build abstract models based on assumptions which describe a link between conduct and the effect of that conduct. … The difference in methodology can lead to considerable difficulties in competition law. Lawyers dismiss economic modeling because the assumptions of the economic model rarely match the facts of a particular case ")

[137] Daryl Lim, *Copyright Under Siege: An Economic Analysis of the Essential Facilities Doctrine and the Compulsory Licensing of Copyrighted Works*, 17 ALB L.J. SCI. & TECH. 481, 551-553. [footnotes omitted]

on the electronics sector and in particular on semiconductors, which is a 'traditional strength' and research is primarily experimental or applied. Very few dollars go to basic research. There is little public data about the exact size of the various 'new' sectors such as biotechnology, clean technology, nanotechnology and interactive digital media but these are likely to be small because they are 'new' to Singapore.

One of the more significant drivers of Singapore's success is its ability to eclectically emulate the best practices of more experienced countries, and then internalise and institutionalise those practices within a relatively short amount of time. In less than 20 years, Singapore has moved from a jurisdiction sparse in IP protection and rife with piracy to a technologically driven economy offering one of the highest levels of IP protection in the world.[138] Singapore's IP laws try to balance the rights to investments returns with policies designed to disseminate and encourage third-party innovation. Looking ahead, there are a number of tasks for competition jurisprudence to resolve. Singapore will benefit from the experience elsewhere but must decide how best to address the Interface, either from within the IP system or within competition law, or a cocktail of both. But "competition law is an area of where law in which there is little scope for absolute concepts or sharp edges"[139] and the actual contours of the law will not be known until Singapore courts have had opportunity to decide on cases dealing with the Interface.

TABLES

[138] Ng-Loy Wee Loon, *Singapore*, in INTELLECTUAL PROPERTY IN ASIA: LAW, ECONOMICS, HISTORY AND POLITICS 237 (Paul Goldstein and Joseph Straus ed., 2009) (The change in Singapore's attitude towards IP started in the mid-1980s, corresponding to the shift in the country's focus toward higher-technology industries such as the software industry… the need to provide the legal framework necessary for the development of a strong software industry in Singapore, so that major international computer companies and software houses planning to set up software development centers in Singapore could be assured that their products would be adequately protected.") See also the Second Reading of the Copyright Bill, HANSARD, vol. 48, col. 11-12 (May 5, 1986)

[139] *The Racecourse Association and Others v. OFT* [2005] CAT 26,] Case Nos 1035/1/1/04 at [167.("[C]ompetition law is not an area of law in which there is much scope for absolute concepts or sharp edges.")

Table 1: Comparisons of Prosperity

GDP per capita (PPP) growth, CAGR	**Singapore**	**Hong Kong**	**Ireland**	**Norway**	**Switzerland**	**Taiwan**	**Japan**	**South Korea**	**United States**
1965-1985	7.2%	5.0%	3.1%	3.5%	1.5%	7.1%	4.9%	7.1%	2.2%
1986-1997	5.8%	4.1%	5.7%	2.6%	0.6%	4.6%	2.6%	7.1%	1.9%
1997-2008	3.3%	3.1%	4.7%	2.0%	1.5%	3.7%	1.0%	3.8%	1.7%
1965-2008	3.6%	3.5%	3.2%	2.1%	0.9%	4.1%	1.7%	4.4%	1.5%
2008 GDP per capita '000 of *1990 PPP US$*	29.2	30.4	28.3	29.5	24.9	22.2	23.1	20.0	31.4

Source: Total Economy Database (January 2009), The Conference Board and Groningen Growth and Development Centre.

Table 2: Profitability of FDI in Selected Industries

Industry	Return on Investment		FDI Inward Stock	
	2001-07 average	2007	in 2007 (S$ mill.)	Growth (01-07)
Banking Services	41.3%	35.1%	11,319	-4.5%
Instrumentation, Photographic & Optical Goods	40.6%	40.9%	2,765	-26.0%
Pharmaceutical Products	22.4%	38.9%	47,435	19.4%
Water Transport Services	21.5%	19.2%	26,941	12.1%
Insurance Services	20.4%	-2.8%	10,059	-1.0%
Refined Petroleum Products	20.1%	41.9%	14,148	2.8%
Chemicals & Chemical Products	18.8%	17.0%	6,837	42.1%
Electronic Products & Components	18.6%	17.6%	28,241	-15.3%
Transport Equipment	18.0%	25.0%	3,564	30.3%
Wholesale Trading Services	16.6%	23.4%	72,116	10.6%
Machinery & Equipment	14.8%	16.6%	5,180	32.5%
Other Financial Services	12.7%	27.1%	13,450	-27.1%
Warehousing, Post & Courier Services	11.6%	10.8%	3,187	2.6%
Rental & Leasing Services	7.6%	5.0%	5,511	-22.6%
Real Estate Services	7.2%	26.3%	12,179	6.8%
Business Services	6.8%	13.8%	16,239	28.3%
Hospitality and Food Services	5.1%	8.4%	3,006	-5.6%
Investment Holding Services	4.6%	6.5%	157,363	-0.6%
Information and Communications Services	3.8%	15.4%	4,754	36.9%
All Industries/Total	**14.00%**	**17.8%**	**457,024**	**3.5%**

Sources: Foreign Equity Investment in Singapore (2005-2007 editions), all published by the Singapore Department of Statistics.

Table 3 Financial Statistics of Singapore's 1,000 Largest Companies

	2008 Financial Indicators, S$ per employee			
	GLC	non-GLC	Foreign	All Firms
Revenues	542,321	381,369	2,387,977	905,950
Net Income	105,632	48,817	132,375	80,461

Source: Singapore Top 1000, provided by the DP Information Network Pte. Ltd.

Note: Domestic firms include Government linked companies (GLC) and private domestic firms (non-GLC)

Table 4: Global Share of Singapore-owned Intellectual Property

	Share of Applications				Share of Approvals			
Year	**Patents**	**Trade marks**	**Industrial Designs**	**Utility Models**	**Patents**	**Trade marks**	**Industrial Designs**	**Utility Models**
2001	0.0518%	0.1514%	0.1091%	0.0012%	0.1878%	0.2439%	0.0672%	0.0014%
2002	0.0610%	0.2017%	0.0866%	0.0039%	0.2878%	0.3075%	0.1159%	0.0031%
2003	0.1201%	0.2878%	0.1636%	0.0034%	0.4844%	0.4663%	0.1513%	0.0027%
2004	0.1234%	0.2669%	0.2164%	0.0000%	0.3802%	0.4945%	0.2017%	0.0000%
2005	0.1056%	0.2650%	0.1582%	0.0010%	0.3796%	0.5055%	0.2266%	0.0008%
2006	0.1303%	0.2691%	0.1149%	0.0019%	0.3463%	0.4727%	0.1261%	0.0005%
2007	0.2035%	0.3745%	0.1548%	0.0107%	0.6208%	0.6632%	0.2302%	0.0066%

Source: WIPO Patents, Trademarks, and Industrial Designs Database 2008.

Table 5: Comparison of Granted Intellectual Property to Residents

Country	*2001-2007 average*			*per 10,000 population in 2008*		
	Patents	**Trademarks**	**Industrial Designs**	**Patents**	**Trademarks**	**Industrial Designs**
Denmark	2,131	8,107	610	3.89	14.78	1.11
Finland	4,103	4,850	842	7.82	9.25	1.61
France	23,302	47,695	32,543	3.73	7.63	5.21
Germany	50,430	137,664	52,008	6.10	16.66	6.29
Hong Kong	312	6,937	2,275	0.44	9.88	3.24
Ireland	872	2,285	164	2.10	5.50	0.39
Japan	192,448	109,090	38,637	15.12	8.57	3.04
Netherlands	8,488	5,761	1,525	5.10	3.46	0.92
Norway	1,151	2,464	286	2.48	5.30	0.62
Singapore	748	5,740	564	1.62	12.46	1.22
South Korea	60,385	45,630	29,887	12.48	9.43	6.18
Sweden	7,606	11,187	1,160	8.41	12.37	1.28
Switzerland	8,501	49,882	11,704	11.21	65.79	15.44
United Kingdom	13,314	40,136	4,605	2.18	6.59	0.76
United States	142,258	206,385	22,372	4.68	6.79	0.74

Source: WIPO Patents, Trademarks, and Industrial Designs Database 2008.

Table 6: U.S. Patent Ownership, 2008

	Utility patents owned	per million population	Avg. Annual Growth 1999-2008
World	157,772	23.10	0.31%
United States	77,501	246.16	-0.88%
Japan	33,682	264.89	0.88%
Germany	8,915	108.50	-0.51%
South Korea	7,549	156.19	8.35%
Taiwan	6,339	275.92	6.00%
France	3,163	50.74	-2.10%
United Kingdom	3,094	50.26	-1.61%
Netherlands	1,329	80.10	0.71%
China	1,225	0.91	29.01%
Israel	1,166	162.63	5.01%
Switzerland	1,112	146.94	-1.55%
Sweden	1,060	114.60	-3.10%
Finland	824	154.72	2.65%
India	634	0.53	19.26%
Singapore	399	84.23	11.32%
Denmark	391	71.48	-2.44%
Hong Kong	311	44.29	7.74%
Norway	273	56.73	2.20%
Ireland	164	36.32	6.67%

Source: USPTO Databases.

Table 7: WIPO-Registered Patent Applications by Field of Technology (2002-2006)

	Electrical Engineering	Mechanical Engineering	Instruments	Chemistry	Other Fields	Total Applications
World	31.32%	23.20%	17.30%	23.82%	4.37%	3,236,551
China	28.47%	17.80%	17.54%	32.65%	3.54%	146,646
Denmark	8.88%	22.49%	21.04%	44.70%	2.90%	3,594
Finland	46.61%	23.21%	9.96%	18.58%	1.65%	28,837
Germany	18.03%	35.55%	15.33%	27.60%	3.49%	159,822
Ireland	17.86%	20.08%	23.56%	33.31%	5.19%	2,408
Japan	36.67%	24.29%	17.29%	17.42%	4.33%	1,344,446
Netherlands	38.32%	16.22%	16.61%	25.57%	3.29%	58,829
Norway	15.06%	36.30%	15.75%	28.12%	4.77%	3,097
Singapore	49.95%	12.32%	19.30%	15.94%	2.49%	6,695
South Korea	49.61%	19.32%	12.29%	13.11%	5.65%	372,435
Sweden	23.68%	26.24%	20.40%	26.92%	2.77%	24,904
Switzerland	10.43%	22.86%	24.00%	38.74%	3.97%	15,077
United Kingdom	19.55%	22.42%	20.55%	31.59%	5.89%	49,405
United States	30.70%	17.29%	18.95%	28.88%	4.17%	757,589

Source: WIPO Statistics Database, July 2009.

Table 8: Intellectual Property filed in Singapore and by Singaporeans (2001-2008)

Patents filed in Singapore				**Patents filed by Singaporeans**			
Top Country Appliers		*Top Country Holders*		*Top Countries Applied*		*Top Countries Held*	
USA	29.58%	USA	32.47%	USA	39.63%	Singapore	46.79%
Japan	11.86%	Japan	17.94%	Singapore	33.67%	USA	38.71%
Singapore	7.05%	Germany	16.03%	EPO	5.97%	EPO	5.75%
Germany	4.40%	Singapore	5.54%	China	4.58%	Japan	1.66%
Switzerland	3.26%	UK	5.17%	Australia	3.20%	China	1.13%
All others	43.85%	All others	22.84%	All others	12.95%	All others	5.96%
Total Filed	61,065	Approved	47,354	Total Filed	12,785	Approved	5,236

Trademarks registered in Singapore				**Trademarks registered by Singaporeans**			
Top Country Appliers		*Top Country Holders*		*Top Countries Applied*		*Top Countries Held*	
Singapore	23.21%	USA	23.46%	Singapore	65.42%	Singapore	72.50%
USA	21.95%	Singapore	19.89%	China	11.80%	China	7.36%
Japan	8.52%	Japan	9.35%	Australia	3.14%	Australia	3.16%
Germany	5.79%	Germany	6.43%	Thailand	2.54%	Thailand	2.15%
UK	4.36%	UK	5.23%	USA	1.34%	Hong Kong	1.22%
All others	36.17%	All others	35.64%	All others	15.77%	All others	13.60%
Total Filed	133,658	Approved	146,468	Total Filed	47,418	Approved	40,178

Industrial Designs filed in Singapore				**Industrial Designs filed by Singaporeans**			
Top Country Appliers		*Top Country Holders*		*Top Countries Applied*		*Top Countries Held*	
Singapore	23.12%	Japan	23.62%	Singapore	71.72%	Singapore	73.85%
Japan	22.18%	Singapore	22.02%	USA	7.76%	USA	5.47%
USA	8.44%	USA	8.87%	China	5.96%	China	5.35%
Switzerland	8.08%	Switzerland	7.83%	Japan	2.17%	France	3.52%
Netherlands	3.71%	Netherlands	3.79%	OHI (EU)	1.85%	Australia	2.20%
All others	34.46%	All others	33.86%	All others	10.55%	All others	9.60%
Total Filed	13,588	Approved	13,236	Total Filed	4,381	Approved	3,947

Source: WIPO Patents, Trademarks, and Industrial Designs Database 2008.

Table 9: Innovation Input Trends in Singapore

Year	Research scientists & engineers per 1,000 labour force	GERD per capita (current S$)
1994	38.50	342.76
1995	47.70	385.72
1996	50.10	488.02
1997	53.40	553.50
1998	57.80	638.30
1999	62.60	669.47
2000	66.10	745.53
2001	65.90	784.59
2002	67.50	811.06
2003	73.80	800.71
2004	80.90	932.94
2005	90.10	1,035.36
2006	87.40	1,115.21
2007	90.40	1,392.29
2008	87.60	1,546.84

Source: A*Star's "National Survey of R&D in Singapore 2008".

Table 10: Comparison of R&D Spending

Country	Year	Private Sector	Higher Education	Government & Public Institutes	Total Spending as % of GDP
Denmark	2007	64.92%	27.49%	7.59%	2.54%
Finland	2008	72.31%	19.01%	8.68%	3.41%
France	2007	63.18%	19.17%	17.66%	2.08%
Germany	2007	69.95%	16.33%	13.72%	2.53%
Ireland	2008	66.96%	26.04%	6.99%	1.42%
Japan	2006	77.16%	12.69%	10.15%	3.39%
Netherlands	2007	60.42%	26.55%	13.04%	1.73%
Norway	2007	51.25%	32.83%	15.93%	1.57%
Singapore	2008	71.83%	9.96%	18.21%	2.77%
South Korea	2006	77.26%	9.95%	12.79%	3.23%
Sweden	2007	72.73%	21.07%	6.20%	3.63%
Switzerland	2004	73.74%	22.90%	3.36%	2.90%
Taiwan	2006	67.50%	12.23%	20.27%	2.58%
United Kingdom	2006	61.65%	26.12%	12.22%	1.78%
United States	2007	71.91%	13.26%	14.83%	2.68%

Sources: OECD Science & Technology Indicators 2009 and A*Star's "National Survey of R&D in Singapore 2008".

Table 11: Comparison of Private R&D Spending

	Year of Data	Aero-space	Elect-ronics	Office Machinery and Computers	Pharma-ceuticals	Scientific Instruments	Other Manufac-turing	Services	Total Spend (mill. US$)
Denmark	2006	0.00%	4.08%	0.00%	28.78%	6.67%	26.94%	33.54%	3,155
Finland	2004	0.40%	49.51%	0.10%	4.93%	2.79%	27.76%	14.52%	3,782
Germany	2005	5.14%	8.49%	1.41%	8.77%	6.76%	59.35%	10.09%	43,304
Ireland	2005	0.19%	12.57%	5.80%	20.07%	9.35%	18.41%	33.60%	1,300
Japan	2003	0.45%	13.08%	12.71%	7.51%	4.27%	52.83%	9.14%	84,180
Netherlands	2006	0.71%	21.81%	0.00%	10.05%	2.79%	42.74%	21.90%	6,125
Norway	2004	0.27%	6.18%	0.13%	3.58%	5.43%	49.13%	35.28%	1,698
Singapore	2006	0.63%	40.99%	0.00%	7.69%	2.25%	15.75%	32.68%	3,144
South Korea	2006	0.80%	47.94%	1.54%	2.17%	1.35%	39.15%	7.06%	27,725
Sweden	2003	3.24%	22.10%	1.01%	19.52%	5.52%	38.18%	10.42%	7,713
Switzerland	2004	0.00%	8.59%	0.00%	36.90%	5.64%	29.30%	19.57%	5,515
Taiwan	2006	0.00%	52.12%	14.96%	1.12%	2.77%	21.57%	7.46%	11,173
United Kingdom	2005	16.21%	6.12%	0.45%	25.39%	3.35%	27.97%	20.51%	20,512
United States	2006	6.61%	12.47%	2.94%	15.71%	9.04%	24.12%	29.11%	247,669

Source: OECD Science & Technology Indicators 2009.

Table 12: Comparison of Researchers (full time equivalent per thousand employees)

Country	Year	Private Sector	Higher Education	Government	Public Institutes	Overall
Finland	2007	8.83	4.87	1.80	0.14	15.64
Japan	2006	7.53	2.87	0.52	0.13	11.05
Denmark	2007	6.35	3.15	0.78	0.07	10.35
Singapore	2007	6.07	2.70	0.59	0.86	10.22
Taiwan	2007	6.05	2.55	1.39	0.06	10.05
Sweden	2007	6.06	3.28	0.44	0.01	9.79
United States	2005	7.62	1.26	0.33	0.42	9.64
Norway	2006	4.79	3.23	1.45	—	9.48
South Korea	2006	6.72	1.23	0.61	0.09	8.65
Germany	2007	4.40	1.71	1.08	—	7.19
Switzerland	2004	3.03	2.95	0.10	—	6.08
Ireland	2006	3.43	2.29	0.24	—	5.96
United Kingdom	2006	3.00	1.50	0.29	1.08	5.86
Netherlands	2007	3.05	1.30	0.80	—	5.15

Sources: OECD Science & Technology Indicators 2008/2; Taiwan Science & Technology Indicators 2008 (National Science Council of Taiwan); Yearbook of Manpower Statistics 2008 (Singapore Ministry of Manpower).

Table 13: Comparison of R&D Personnel (full time equivalent per thousand employees)

Country	Year	Private Sector	Higher Education	Government	Public Institutes	Overall
Finland	2007	12.81	6.62	2.94	0.19	22.56
Sweden	2007	13.44	3.88	0.75	0.02	18.08
Denmark	2007	10.49	4.34	1.18	0.10	16.11
Japan	2006	9.64	3.72	0.98	0.22	14.57
Norway	2007	6.72	4.44	2.23	—	13.39
Taiwan	2007	9.12	1.93	1.78	0.06	12.89
Germany	2007	8.05	2.46	2.01	—	12.52
Switzerland	2004	7.92	4.39	0.19	—	12.51
Singapore	2007	7.09	2.88	0.91	1.17	12.06
United Kingdom	2006	4.77	3.45	0.64	1.82	10.68
Netherlands	2007	5.75	3.47	1.42	—	10.64
South Korea	2006	7.42	1.91	0.82	0.12	10.27
Ireland	2007	5.34	2.83	0.59	—	8.77

Sources: OECD Science & Technology Indicators 2008/2; Taiwan Science & Technology Indicators 2008 (National Science Council of Taiwan); Yearbook of Manpower Statistics 2008 (Singapore Ministry of Manpower).