6. From trade hub to innovation hub: Hong Kong

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1 INTRODUCTION

In recent years Hong Kong has gone some way towards regaining its traditional position as the key transit point for exchange of both goods and services between China and the international economy. Sophisticated and reliable intermediary services occupy a key role in maintaining this status, and Hong Kong's future apparently turns on the capacity of its intermediaries to maintain a considerable share of business within Asia and between it and the global economy (Meyer, 2000, p. 247). As a trade hub linking China with global markets, Hong Kong's position in Asia has been unrivalled.

Hitherto, technological innovation in Hong Kong has however not been regarded as an important element of Hong Kong's developmental experience, and the few studies that have addressed the issue have emphasized the *laissez-faire* policies that have characterized the industrialization process in Hong Kong (e.g. Hobday, 1995). Hong Kong's entrepreneurs have been adept at exploiting available technology from the international market, but they have not generally carried out R&D for the purposes of creating proprietary technology on their own (Davies, 1999). For this reason, technological innovation has only recently begun to attract serious attention in Hong Kong, where the government in 1998 launched a new strategy in pursuit of knowledge-intensive economic growth.

Our point of departure for this report is that the transition to a new position as an innovation hub for China presents new challenges for its national system of innovation (NSI). In building its capabilities in innovation and technology development (including organizational and service innovations), Hong Kong can take advantage of the skills it acquired as a trading hub, combine them with the strong basic research capabilities contained in its universities, and apply them in order to become an innovation hub between the Pearl River Delta (PRD) and the rest of the world.

Following the return of Hong Kong to Chinese sovereignty and the Asian financial crisis of the late 1990s, the territory must further leverage its unique position as a gateway that provides high value-added services to global production chains linking China and the world. This task requires improvements in the R&D intensity of many sectors in Hong Kong's economy and the strengthening of innovative activities in the private sector. Accordingly, the Hong Kong government has adopted a more proactive approach to maintaining and further developing its competitiveness. The momentum of ongoing integration with the Chinese economy means that organizations in Hong Kong will increasingly locate many innovative activities on the mainland. For this reason, linkages with regional and global systems of innovation (SI) remain a key priority for Hong Kong.

2 MAIN HISTORICAL TRENDS

The Hong Kong story makes a fascinating tale of how what was a barren rock 150 years ago has emerged as a dynamic and vibrant world city.[1] In reality, Hong Kong's phenomenal economic growth has transpired over a shorter period covering the last four or five decades. Nevertheless, the foundation was laid over a longer period.

2.1 Early Twentieth Century

Studies of Hong Kong's economic development in the early part of the twentieth century have shown that a combination of informal institutions and state initiatives supported industrialization, relying primarily on small-scale manufacturers linked in familial or ethnic networks and connected with expanding markets for relatively low-technology products in China, South-East Asia and Europe/the USA (Clayton, 2000). Official British colonial history, reflecting primarily the perspective of the major British 'Hongs' or trading houses, which had little commercial interest in manufacturing and instead emphasized the promotion of the entrepot trade, has largely neglected the growth of such industries in Hong Kong (Loh, 2002).[2]

2.2 The Cold War Period – 1950s to 1970s

The overthrow of the Kuomintang (KMT) regime of General Chiang Kai Shek in 1949 by the founders of the current government of the People's Republic of China (PRC) led to an exodus of about one million Mainland Chinese to Hong Kong. The people of Hong Kong, including its migrants, thus grew up and developed in a community that had Chinese roots but a

British administration. These migrants, in turn, accelerated the establishment and growth of manufacturing industries that further expanded Hong Kong's traditional role as an entrepot. In the face of the declining power of the KMT in China, Shanghai textile barons transferred enormous amounts of capital and managerial expertise in textile manufacturing to the colony (Wong, 1988). Today it is estimated that over half of Hong Kong's more than 7 million citizens are descendants of post-1949 migrants.

2.3 The Opening of China – 1980s and 1990s

Given Hong Kong's singular position as a British Crown colony on the doorstep of the most populous country in the world, politics naturally shaped its NSI significantly. In this respect the two most significant events around 1980 were the modernization programme that the late Chinese leader Deng Xiaoping promulgated in 1978 and discussions between the Chinese and British governments that opened in 1982 over the future of Hong Kong. The latter negotiations ended in 1984 with the signing and ratification of the Sino-British Joint Declaration stating that Hong Kong would become a Special Administrative Region (SAR) of the PRC and that Hong Kong's capitalist system and 'way of life' would be preserved for 50 years. The 'one country–two systems' framework under which Hong Kong is presently governed was subsequently enshrined in the 'Basic Law', the present constitution of the HKSAR.

2.4 From Crown Colony to SAR

As Hong Kong approached its return to China in 1997, it was proudly boasting that no other society had more experience in investing and producing in China. Indeed, since the mid-1980s Hong Kong has been the largest source of foreign direct investment in China, and although the exact figures are impossible to determine, various statistical sources estimate that Hong Kong's contribution to realized foreign investment in China comprised by 1994 about two-thirds of the total (Berger and Lester, 1997, p. 5). It is on this basis that Enright et al. accurately describe how Hong Kong's historical role as a city of departure from China has laid the foundation for a reverse flow of business investments during the 1990s not only back to Hong Kong, but also to Mainland China through Hong Kong. They claim that this has 'helped Hong Kong become the de facto capital of the 50 million or more overseas Chinese who today play such an important role in the economic modernization of the Asian region and in the reconstruction of China's market economy' (Enright et al., 1997, p. 7).

The economic impact is considerable, since overseas Chinese investors – often Hong Kong companies or investors operating out of Hong Kong – now employ at least 14–15 million people in China. It is equally important that the migration of production facilities to the PRD in many ways represented growth, rather than decline, in Hong Kong's engagement in manufacturing. For political reasons such growth was however categorized as outside the territory even if it was, from a historical perspective, a reintegration into Chinese markets. This has also benefited the service industries in that most of the migration spurred further growth and increased the sophistication of producer business services (Tao and Wong, 2002). In establishing and upgrading these networks, Hong Kong firms have exploited their traditional strategies of imitation and followership, while emphasizing the development of organizational know-how rather than formal R&D for new products.

In summary, since the handover, Hong Kong and China – the PRD in particular – have entered a phase during which economic and political ties between the two have strengthened and the scope for collaborative innovation has widened.

3 INNOVATION INTENSITY

The data provided to indicate the propensity to innovate in Hong Kong are derived from an innovation survey administered in 2002 and 2003 according to criteria and specifications formulated by the Census and Statistics Department. This is a secondary source that does not conform to the precise requirements of the present comparative study of national SI, and such discrepancies should be kept in mind when interpreting the data.

Knowledge-intensive business services (KIBS) generally shows the greatest commitment to innovation and R&D activities, with manufacturing second, finance third and trade the least committed (see Table 6.1). Since the initiation of the open-door policy of China, Hong Kong has become an international financial centre as well as the service and information hub of Asia. The category of trade includes many firms that have manufacturing facilities in the PRD, while the Hong Kong office is responsible for planning, marketing and development. This relationship between Hong Kong and southern China is often described as *qian dian hou chang* (Hong Kong as the shop front and China as the factory at the back).

It is interesting that the figures for turnover due to products new to the firm demonstrate that the trade sector takes the largest advantage of new products. KIBS and manufacturing are in the second and third positions, respectively, although they commit more resources to innovation and R&D

Table 6.1 Indicators for innovation levels in Hong Kong SAR

	Sectors						Size	
	All firms	Manufacturing	Finance	KIBS	Trade	Others	Small	Large
ININT2K	0.0024	0.0064	0.0039	0.0246	0.0013	0.0011	0.0019	0.0032
RDINT2K	0.0011	0.0025	0.0001	0.0196	0.0006	0.0004	0.0010	0.0012
TURNIN	0.1170	0.0730	0.0260	0.1400	0.2260	0.0230	0.1480	0.1060
TURNINMAR	0.0004	0.0002	0.0001	0.0008	0.0007	0.0000	0.0004	0.0040
NTTM	0.0461	0.0184	0.3412	0.0699	0.0504	0.0282	0.0412	0.2096
INPCS	0.6892	0.5903	0.4118	0.6434	0.7047	0.7841	0.6908	0.6331
INNO	0.0622	0.1391	0.0087	0.0863	0.0567	0.0479	0.0610	0.1823

Variables: ININT2K: Innovation intensity in year 2000; RDINT2K: R&D intensity in year 2000; TURNIN: Turnover due to 'new-to-the-firm' products; TURNMAR: Turnover due to 'new-to-the-market' products; INPDT: Introduction of 'new-to-the-firm' products; NTTM: Introduction of 'new-to-the-market' products; INPCS: Introduction of new processes; INNO: Innovating firms.

Source: Own calculations based on data supplied by the Hong Kong SAR Census and Statistics Department figures.

than trade does. Most probably the reasons for the high proportion of new products in the trade sector are related to extensive subcontracting of new products to manufacturing in the mainland, with or without local R&D. In other words, many of the Hong Kong firms categorized under the trade sector are in fact undertaking the manufacture of new products in the mainland on behalf of clients overseas – where most of the R&D related to these new products were carried out by the overseas clients, not by the Hong Kong firm.

For the turnover due to 'new-to-the-market' products, KIBS is slightly ahead of trade while manufacturing remains third. This means that firms in the KIBS sector are likely to be launching more original new service products than those offered by trading companies. These figures also remind us that Hong Kong, with its information-intensive service industry, makes its living by providing services to an international clientele.

Compared to other small economies, the figure for the share of Hong Kong firms introducing new-to-the-market products – 0.0461 compared with an average of 0.3426 for small European countries – indicates that Hong Kong has performed poorly in product innovation. Only the finance sector has a proportion of firms introducing new-to-the-market products that is comparable with those of European countries. The relative weakness of product innovation recalls the popular wisdom about Hong Kong's economy that the territory is good only at reproducing others' innovations.

The figures for the introduction of new processes in various sectors of Hong Kong's economy are better than those for new products. The average figure of 0.6892 for Hong Kong is comparable to that obtained by other small economies, which scored an average 0.6619 in 1994–96 (see Appendix Table A4.7). Perhaps this is because Hong Kong, as a service economy, is more prone to introduce new processes than new products. New processes may simply be improvements to existing processes, and the indicator is a reflection of the fact that organizational change and innovative management remain important elements of competitiveness in Hong Kong. For example, efforts to improve quality (see Section 4.2.2) and raise total factor productivity (TFP) in both manufacturing and tradable services (see Section 5) have been a key concern of organizations such as the Hong Kong Productivity Council. This bias towards non-technological innovations is also reflected in Figure 6.1, where non-technological innovations far outnumber innovations focused on new technology.

Although, as a sector, KIBS has demonstrated a stronger potential to innovate, manufacturing nevertheless is slightly ahead of KIBS in exhibiting

the largest proportion of innovative firms. However, the difference between the two sectors is very small (0.4 per cent). Instead, it is noteworthy that manufacturing and KIBS have more than twice the proportion of innovative firms as trade, and even more with respect to finance and other industries. These figures must be understood in context: trading firms focus on the marketing of new products, but do not carry out significant innovative activities or R&D on their own.

Finally we note that large enterprises, even if they constitute only a small proportion of all companies in Hong Kong, are far ahead of the small and medium-sized companies in terms of propensity to innovate. The indicators above, except turnover due to new products, illustrate that there is an immense need to revitalize the economy by assisting the small and medium-sized enterprises (SMEs) to become more innovative in a knowledge-based economy. In September 2004, there were about 282 000 SMEs in Hong Kong. They accounted for over 98 per cent of the total number of firms in Hong Kong. The majority of Hong Kong's SMEs are family-run enterprises, with much overlap between ownership and management, centralized decision making, high levels of family orientation (nepotism), the widespread use of personal networks, great flexibility and adaptability to changing market conditions, an emphasis on pragmatism over legalism and dependence on internal sources (as opposed to organizational external sources) for raising finance. In contrast, large firms, which constitute 2 per cent of all establishments in Hong Kong, undertake the largest amount of innovation expenditures (in dollar terms). Key statistics on the innovation activities of small, medium-sized and large firms for 2001 and 2002 are provided in Table 6.2.

As Table 6.2 shows, innovative activities are undertaken the least by small enterprises. Coinciding, however, with the government's effort to raise the awareness and importance of innovation among all Hong Kong firms, we see an increase in the percentage of SMEs undertaking innovative activities in 2002 as compared with 2001. While the number (and percentage) of large firms undertaking innovative activities dropped in 2002, their innovation expenditure continued to constitute over half of all innovation expenditure among businesses in Hong Kong.

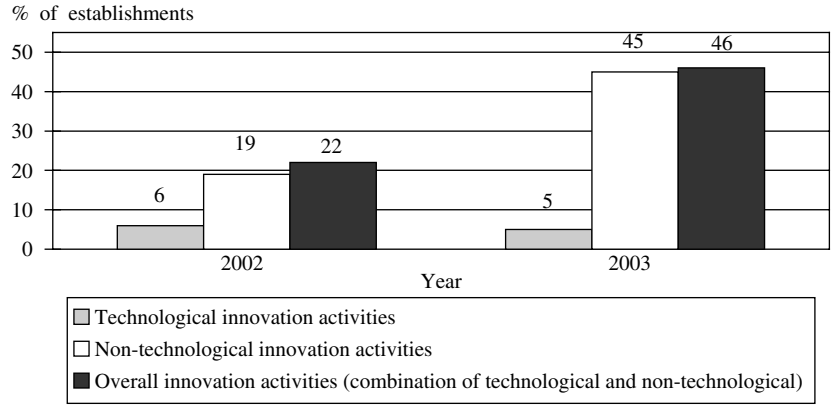
The propensity to innovate among organizations in Hong Kong is heavily biased towards non-technological innovations. Figure 6.1 shows that although innovative activities have increased among Hong Kong firms surveyed in 2002 and 2003, efforts devoted entirely to technology innovation actually declined. Most innovation involved both technological innovation and non-technological innovation, and a substantial proportion was concerned only with non-technological innovation such as organizational change, marketing, etc.

Table 6.2 Key statistics on innovation activities in the business sector, 2001 and 2002

Size of establishment	Year	Total number of establishments	Number of establishments having undertaken innovation activities[1]	Innovation expenditure (HK$ million)[2]
Large	2001	5 781	771 (13.3%)	3 602.8 (53.4%)
	2002	5 083	662 (13.0%)	4 858.1 (55.0%)
Medium	2001	32 591	2 647 (8.1%)	1 987.2 (29.5%)
	2002	28 040	3 974 (14.2%)	2 562.1 (29.0%)
Small	2001	234 315	7 448 (3.2%)	1 156.4 (17.1%)
	2002	232 325	11 877 (5.1%)	1 415.1 (16.0%)
Total	2001	272 688	10 866 (4.0%)	6 746.4 (100.0%)
	2002	265 449	16 513 (6.2%)	8 853.3 (100.0%)

Notes:
1 Innovation activities include produce innovation, process innovation, ongoing innovation activities and abandoned activities. Figures in parentheses represent the percentages to total no. of establishments.
2 Figures in parentheses represent the percentages to total innovation expenditure.

Source: Adapted from HKSAR Census and Statistics department (2002, p. 38).



Note: Figures refer to the percentage of establishments that had undertaken, in the respective years, technological innovation activities or non-technological innovation activities or both.

Source: HKSAR Census and Statistics Department (2004), May.

Figure 6.1 Types of innovation activities undertaken in Hong Kong, 2002–3

4 ACTIVITIES THAT INFLUENCE INNOVATION

4.1 Knowledge Inputs to Innovation

4.1.1 R&D activities

R&D intensity (R&D as a percentage of gross domestic product (GDP)) in Hong Kong has been growing but, at a rate of 0.69 per cent in 2003, it remains very small in comparison with that of other countries with similar GDP per capita. Statistical information on R&D expenditures was not systematically collected in Hong Kong until the mid-1990s (see Table 6.3). In 2001, the Census and Statistics Department initiated annual surveys collecting more detailed data concerning R&D activities and innovation.

Over the period 1995–2001, higher education R&D (HERD) has constituted well over half (60 per cent or more) of total R&D expenditures. At this time, business expenditure on R&D (BERD) made up around one-quarter of the total, while the government sector expenditure on R&D (GOVERD) only was responsible for a tiny fraction. During 2002–3, the contribution of business R&D expenditure grew rapidly, and with a total BERD of HK$4.5 billion (approx. €400 million) in 2003 constituted almost the same amount as HERD (0.36 per cent compared to 0.39 per cent).[3] There are no figures available for the breakdown of R&D expenditures

Table 6.3 R&D expenditure by sector, as percentage of GDP, 1995–2003

Year/sector	1995	1996	1997	1998	1999	2000	2001	2002	2003
BERD	0.12[1]	0.14[1]	0.11[1]	0.12[2]	0.11[2]	0.09[2]	0.16[2]	0.20[2]	0.36[5]
HERD	0.25[4]	0.27[4]	0.29[4]	0.31[2]	0.35[2]	0.38[2]	0.38[2]	0.38[2]	0.39[5]
GOVERD	0.01[3]	0.01[3]	0.01[3]	0.01[2]	0.01[2]	0.01[2]	0.01[2]	0.02[2]	0.02[5]
Total (GERD)	0.38	0.42	0.41	0.44[2]	0.47[2]	0.48[2]	0.56[2]	0.60[2]	0.69[2]

Variables: BERD: business expenditure on R&D; HERD: higher education expenditure on R&D; GOVERD: government expenditure on R&D; GERD: gross domestic expenditure on R&D.

Notes:

1 Figures from 'Feature article', Hong Kong *Monthly Digest of Statistics*, July 2001, p. FC5.

2 Figures from 'Research and development statistics of Hong Kong, 1998–2002', Hong Kong *Monthly Digest of Statistics*, May 2004, p. FD4, Table 2.

3 Estimates based on 1998 and onward figures, Census and Statistics Department.

4 Percentage figures calculated from 'Government funding of R&D, innovation and technology upgrading, 1995/96–2001/02', Hong Kong *Monthly Digest of Statistics*, July 2003, p. FD9.

5 Figures from HKSAR Census and Statistics Department (2005).

between domestic and foreign actors in the business sector, although some foreign firms such as 3M and Motorola are known to have conducted R&D activities in Hong Kong.

Higher education R&D activities are governed by the University Grants Committee (UGC), a government-appointed body that funds the eight organizations for higher education in Hong Kong. In 2000 and 2001 a negligible amount of HERD (less than 1 per cent of the total amount) (HKSAR Census and Statistics Department, 2004) came from parties outside Hong Kong. It can therefore be said that effectively all HERD activity is funded and conducted by domestic actors.

The insignificance of GOVERD reflects a strong belief in the virtue of maintaining small government agencies in Hong Kong, and although much of the territory's R&D funding comes from government sources, the actual expenditure and performance of R&D is generally done by organizations such as the universities or semi-public corporations.

Along with other science and technology (S&T) statistical indicators, data on patents can be regarded as performance indicators of R&D output. The number of patent applications increased from 1092 in 1991 to 9226 in 2001 (see Table 6.4), representing an annual growth rate of 24 per cent (HKSAR Census and Statistics Department, 2003a).

There are two types of patents in Hong Kong, namely the standard patent and the short-term patent. Subject to payment of a renewal fee, a standard patent in Hong Kong has a term of protection of up to 20 years, whereas a short-term patent has a maximum term of eight years. The vast majority of standard patent applications were filed by overseas firms, while 55 per cent of short-term patent applications were filed by Hong Kong residents or firms. At the same time, the number of patents granted by the US Patent and Trademark Office (USPTO) to Hong Kong residents almost doubled, from 279 in the five-year period 1990–94 to 570 in 1995–99 (Mahmood and Singh, 2003). The latest figures from 2004 indicate that 672 patents were granted to Hong Kong residents by USPTO, equivalent to 97.6 USPTO patents per million population (HKSAR Census and Statistics Department, 2005, Table 3.9). Hong Kong also saw 123.9 patents granted by the USPTO per 1000 full-time equivalent researchers, which was a higher ratio than in Taiwan, with 104.7, and Singapore, with 14.5 (Wong and Siu, 2004). These figures indicate that there exists a steady stream of high-quality innovative work carried out through advanced research in Hong Kong. This is a potential source of new inventions and economic growth, even if the results may be commercialized outside the territory.

Another R&D production measure is research output, not directly related to teaching, from the eight higher education organizations in Hong Kong. Research output includes scholarly books, journal articles, book

Table 6.4 Number of patent applications in Hong Kong by type, 1991–2001

Type of patent application/year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Standard							1 179 (49%)	19 139[1] (99%)	6 040 (97%)	8 295 (97%)	8 914 (97%)	9 130 (97%)
Short-term							30 (1%)	113 (1%)	175 (3%)	274 (3%)	312 (3%)	333 (3%)
Repealed[2]	1 092 (100%)	1 259 (100%)	1 195 (100%)	1 640 (100%)	1 961 (100%)	2 100 (100%)	1 215 (50%)					
Total	1 092	1 259	1 195	1 640	1 961	2 100	2 424	19 252	6 215	8 569	9 226	9 463

Notes:

1 The surge of standard patent applications in 1998 was mainly due to the large number of applications filed under the Patent (Transitional Arrangements) Rules.

2 Patent applications filed under repealed Registration of Patents Ordinance.
Figures in parentheses represent the percentages to total.

Source: HKSAR Census and Statistics Department (2003a, p. FC6).

Table 6.5 Research output at eight higher education institutions by broad subject area

Broad subject area/year	1993/1994	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002
Biology and medicine	3 070	3 959	4 722	4 900	5 336	6 149	6 529
Physical sciences	1 092	1 749	1 894	1 910	1 951	2 649	2 764
Engineering	2 495	4 056	4 608	4 829	5 234	6 644	6 309
Humanities, social sciences and business studies	6 484	8 811	10 366	9 247	10 570	11 238	11 494
All subject areas	13 141	18 575	21 589	20 886	23 091	26 680	26 996

Source: Hong Kong *Annual Digest of Statistics*, 2003, p. 128.

chapters and other published papers. Since 1997, research output has numbered above 20 000 items annually (see Table 6.5).

We can discern the pattern of scientific and technological specialization for the higher education sector only. Yet HERD constitutes such a large proportion of overall GERD – well over 60 per cent – that it provides a fairly accurate picture. Most of the expenditure for the higher education sector from 1998 to 2002 was in the physical sciences (between 23 and 25 per cent), engineering and technology (between 22 and 23 per cent), and medicine, dentistry and health (between 18 and 19 per cent). The arts and humanities as well as social sciences each show a 10 per cent share (HKSAR Census and Statistics Department, 2004).

Since the year 2000, the government in Hong Kong has implemented measures to increase the amount spent on R&D because countries with a comparable level of per capita GDP commit 1.5–3 per cent of their GDP on R&D. The point is to leverage Hong Kong's position as a gateway linking China and the world, which the government has recognized as its greatest historical and present-day competitive advantage. Most notable among these measures has been the establishment of the Innovation and Technology Fund (ITF), set up with HK$5 billion (approximately €500 million) earmarked to provide funding for projects that contribute to innovation and technology upgrading in both new and established

industries. The Innovation and Technology Commission (ITC) has also been set up to spearhead Hong Kong's drive to become a world-class knowledge-based society. The ITC manages the ITF and the Applied Research Fund (ARF), and supports such infrastructure projects as the Hong Kong Science Park.

4.1.2 Competence building

Hong Kong has been expanding its post-secondary education system since 1980. As part of its industrial policy the government has sought to facilitate the growth of industrial manufacturing by investing in infrastructure and human capital. To meet the increasing demand for skilled labour, the government has focused policy initiatives on vocational training. During the 1990s, the higher education sector was also expanded significantly. Recently, there have been increasing calls from lawmakers and academics to increase the proportion of students from Mainland China permitted to undertake tertiary education in Hong Kong.

In the higher education sector Hong Kong now provides 14 500 first-year first-degree places to about 18 per cent of the population, who range from 17 to 20 years of age. There are 11 degree-awarding organizations, eight of which are funded by the UGC and offer a total of over 45 000 degree places (in full-time-equivalent terms). Tertiary education constitutes approximately one-third of the government expenditure on education, which in turn is around 4–5 per cent of GDP (Education and Manpower Bureau, 2006).

The Vocational Training Council (VTC) was set up in 1982 to provide and promote a cost-effective and comprehensive system of vocational education and training to meet the needs of the economy. It operates the Hong Kong Institute of Vocational Education (IVE), including the VTC School of Business and Information Systems (SBI), industrial training and development and skills centres. It also administers the Apprenticeship Ordinance. IVE offers higher diploma, diploma, higher certificate, certificate and craft-level courses, which are designed to enable young people to build successful careers in industry and services. In November 2003, the VTC had enrolled 27 700 full-time and 26 300 part-time students (Vocational Training Council, 2004, p. 24).

Reflecting the territory's colonial past, many students from Hong Kong have pursued university education in the UK. It is also very popular to supplement basic educational degrees gained in Hong Kong with postgraduate degrees, at universities abroad. In particular, there is a considerable market for MBA degrees, and several programmes are offered in a combination of local and overseas studies. Universities from the UK to USA to Australia have long operated a sophisticated higher education marketplace in Hong Kong, which has been a highly rewarding location in which to

recruit students and deliver extension programmes. Nearly 30 000 students from Hong Kong study abroad each year. This market-based, transnational flow of university students represents perhaps the highest proportion within any post-secondary system in the world.

Public expenditure on education in Hong Kong has been approximately 23 per cent of the government budget in recent years. An expenditure of 4.7 per cent of GDP for education puts Hong Kong at a level of low spenders among OECD countries, similar to Spain and Japan (OECD, 2005, p. 176). About one-third of government expenditure towards education goes to tertiary education.

Largely because of the expansion of Hong Kong's university system, the past decade has seen a significant increase in the number of people who have obtained degrees from tertiary education organizations, as indicated in Table 6.6.

The introduction in 2001 of associate's degrees in post-secondary education programmes has also provided additional opportunities for people to develop their qualifications in Hong Kong and abroad. These new programmes are financed by private sources, in contrast to the bachelor's

Table 6.6 Population aged 15 and over by educational attainment (highest level attended), 1991, 1996 and 2001

Educational attainment	1991		1996		2001	
	Number	% of total	Number	% of total	Number	% of total
No schooling/kindergarten	557 297	12.8	480 852	9.5	469 939	8.4
Primary	1 100 599	25.2	1 146 882	22.6	1 148 273	20.5
Lower secondary	837 730	19.1	958 245	18.9	1 060 489	18.9
Upper secondary	1 169 271	26.7	1 403 211	27.7	1 473 681	26.3
Matriculation[1]	214 577	4.9	308 808	6.1	528 090	9.4
Tertiary						
Non-degree course	234 912	5.4	243 004	4.8	209 878	3.7
Degree course	255 979	5.9	525 516	10.4	708 622	12.7
Total	4 370 365	100.0	5 066 518	100.0	5 598 972	100.0

Note: [1] Figures include the equivalent educational attainment (highest level attended) of 'technician level (other further non-advanced education)' in the 1996 Population By-census and 'Diploma/certificate courses in institute of vocational education/former polytechnics' in the 2001 Population Census. The similar group 'Diploma/certificate courses in technical institutes/polytechnics' was included under 'Tertiary: non-degree course' in the 1991 Population Census.

Source: HKSAR Census and Statistics Department.

degree programmes already offered by the universities, which draw most of their funding from government sources. During the 2004–5 academic year, 90 associate's degree programmes were offered, together with 80 higher diploma programmes and 19 bachelor's degree programmes, under self-financing arrangements.

Until 20 years ago the colonial government deliberately maintained highly elitist access to the university system, funding fewer than 2000 new student enrolments annually in the UGC-run universities. A major change in policy was introduced by the then-British governor David Wilson in 1989, with the expansion of tertiary education through the creation of new universities during the 1990s. The primary and secondary schools still tend to fall into several categories – from elite to basic – but Hong Kong students in general have been highly ranked with respect to educational performance in mathematics, in which they ranked first out of 41 nations in a test emphasizing mathematical comprehension (Grimm, 2004).

The most important recent policy shift was signalled by Chief Executive Tung Chee-Hwa in 2000, when he proposed a reconfiguration of the post-secondary system for training and general education. Under this policy 60 per cent of young people would continue to study beyond the secondary level by 2010, representing more than double the current participation rate and ten times the rate in 1989. Moreover, the government declared that this expansion of the educational system should be driven by self-financing schemes, not by direct government funding. This policy has had important implications for the educational services market in Hong Kong but it also opens up a range of issues relating to inequality of access to high-quality education and lifelong learning.[4]

4.2 Demand-side Factors

4.2.1 Formation of new markets

Although the formation of new markets can fuel the diffusion of innovation through the stimulation of demand for new products and processes, it has been largely neglected in policy measures throughout Hong Kong's history. A *laissez-faire* attitude, developed during the colonial regime, continues to characterize the community. This attitude in theory opposes all government intervention in a free market economy and therefore also any attempt on the part of the state to engage in the formation of new markets. This contrasts with conditions in Singapore, where the state has pursued an active, opportunistic role in identifying newly emerging market trends. Singapore's strategy is to reap a 'fast-follower' advantage by quickly funnelling resources to capitalize on these new market developments (Chapter 3 Singapore, this volume). The Hong Kong government departed

occasionally from its free market principles to regulate or promote markets that were regarded as essential to society. The cases of property, infrastructure and information technology may illustrate how the state and the private sector have become involved in such initiatives. More significantly, the Hong Kong government has also participated unintentionally in the formation of new markets, apparently unaware of the far-reaching impacts of its policies.

The most notable avenue for market formation has been the government's land supply policies. Hong Kong's population is distributed almost evenly between public and private housing. The supply of land on which residential housing and commercial units can be built is strictly controlled by the government – a legacy of the British colonialists (and a major source of revenue for the government). Hong Kong covers a small geographical area, so land supply and plot ratios (the number of units that can be built on any given area of land) are important factors in determining not only housing supply but also, by extension, property prices. And in an economy where investment options are severely limited, property (both residential and commercial) serves as one of the most important investment and speculation vehicles.[5] As a result, large property developers are among the largest and most influential firms in the territory.

Because of the central nature of property in the economic livelihood of the territory, many economic sectors depend on the demand articulated in the property sector. These include most notably local and foreign construction and engineering companies required to design and construct buildings, banks and other financial service institutions that offer monetary lending services for buyers of property, property estate agents and brokers who serve as intermediaries in property transactions, law firms required to ensure the smooth handover of transactions between parties, architects and decorators involved with fitting out and decoration of units, and property management companies charged with the responsibility of ensuring the good upkeep, maintenance and security of buildings or estates. For all these business services, the rapidly expanding markets with increasing quality requirements provided opportunities for innovations in service products and organizational efficiency. For example, a number of consulting engineering firms became engaged in highly innovative activities (Baark, 2005).

Apart from its high level of regulation in the property sector, the government has also been a major actor in the formation of new markets through the provision of infrastructure for transportation facilities and the information technology sector. In terms of the transportation infrastructure, the government has continually tried to ensure that the public transportation network is up to date, complete and efficient – thus imposing significant requirements for quality and innovation on suppliers. As a

result, the government annually spends large sums on the development and expansion of Hong Kong's road networks. In 1998, it completed the construction of the new airport at Chek Lap Kok, which today has become one of the busiest airports (in terms of both passenger and cargo traffic) in Asia. The government has also actively backed, and in some cases facilitated, the construction of container ports, railways and ferry services. These efforts have combined to aid and bolster Hong Kong's logistics and transportation sector, which has grown in importance as Hong Kong's role as a trade hub has grown and its role as a manufacturing centre has concomitantly declined since the 1980s.

In the information and communications technology sector, we note the launch of the 'Digital 21 Strategy' as a development blueprint to leverage Hong Kong's information technology (IT), Internet and telecommunications infrastructure as platforms from which to reposition and transform a heavily service-oriented economy into an innovation-led and technology-intensive economy. The aims of the strategy are to 'enhance and promote Hong Kong's information infrastructure and services' and to create an environment in which e-business can flourish (HKSAR Information Technology Strategy, 2004).

The government emphasized the development of mechanisms for electronic service delivery – popularly known as the ESD scheme – launched in 2000. In addition, this e-government programme would expand its focus on improving customer interfaces and promoting customer relationship management. Actively pursuing the IT upgrades, the government was also committed to outsourcing the proliferating IT projects starting in 2001. It also strongly emphasized the protection of intellectual property rights (IPR) to ensure promotion and development of IT.

4.2.2 Demand articulation of quality requirements

Within the general framework of an open, market-based economy, the Hong Kong government has traditionally believed that market forces will provide the necessary quality requirements. Both public and private organizations have nevertheless been active in attempts to improve quality requirements and ensure the safety of products, structures and services.

Several government organizations are involved in regulation and the setting of standards as the establishment of a firm institutional framework for maintainance of quality has been an important priority of the government, as will be discussed in Section 4.3.3. For example, the implementation of environmental regulations has developed gradually over some three decades. After years of studies and consultations, the Environmental Protection Agency (EPA) was formed in 1977 to formulate policies and coordinate other departmental activities to protect Hong Kong's environment.

In 1986, the government saw the need to replace the EPA with a separate and more powerful organization with executive powers. As a result, the Environmental Protection Department (EPD) was established.

The Consumer Council was established in April 1974 at a time of inflationary prices and widespread public concern about profiteering. Although the council receives a government subsidy, it enjoys total independence in formulating and implementing its own policy. The Consumer Council Ordinance came into force in July 1977 to provide for the formal incorporation of the Consumer Council. The Consumer Council acts as a watchdog in maintaining the quality of goods and services, and has also produced a number of studies investigating competition in selected sectors.

In response to a worldwide trend and the government's policy of promoting product safety in the territory, the Hong Kong Safety Institute Limited (HKSI) was established to meet perceived requirements in the field of product safety certification. Incorporated in Hong Kong on 7 August 1998, HKSI ways set up to develop, implement and administer the unique third-party product safety certification programme in Hong Kong – the Hong Kong Safety Mark Scheme.

So far, public bodies have not engaged much in R&D related to the development of standards or regulations. They have instead emphasized keeping up with the most advanced testing and inspection methods, and this has required the adoption of advanced equipment and the recruitment of highly trained specialists rather than independent R&D. There has been no attempt to link the implementation of quality standards or regulations with technological development in local industry or services by means of public procurement. In this sense, the output of the services is 'adopted' from abroad rather than indigenously developed.

4.3 Provision of Constituents

4.3.1 Provision of organizations

Hong Kong's business landscape is dominated by SMEs, as opposed to that of Singapore, where industrial development had until the mid-1990s been powered largely by global multinational corporations that had located their operations there. In Hong Kong, SMEs are defined as non-manufacturing enterprises with fewer than 50 employees and manufacturing enterprises with fewer than 100 employees. Although the vast majority of SMEs operate with little attention paid to innovation, a number of small R&D-intensive firms have been formed during the last decade. Many of these are spin-off firms from university research via incubators or independent entrepreneurship. A well-known example is VTech, which has grown from its Hong Kong base to form a global network in R&D and manufacturing (see Box 6.1).

BOX 6.1 VTech – ENTREPRENEURIAL INNOVATING HONG KONG FIRM

Founded in Hong Kong in October 1976 by two engineers, VTech began with only 2000 sq. ft of office space and 40 staff. Sales in the Group's first year were under US$1 million. Today, VTech has operations around the globe and approximately 20 000 employees worldwide. The Group's FY2004 annual results recorded revenue of US$915.2 million – and VTech is still growing rapidly. The VTech Group's three core businesses, including telecommunication products, electronic learning products and contract manufacturing services, incorporate state-of-the-art technology, unique features and value-for-money services.

As a technology-driven company, VTech has placed much emphasis on research and development to maintain its leadership position in the market. To do this, the Group adopted a global R&D strategy. In 1987, it established an R&D centre in North America. In 1988, VTech became one of the first companies to establish R&D facilities in the PRC – tapping the vast resources of Chinese engineering talent. Today, VTech employs approximately 730 R&D professionals in R&D centres in Canada, Hong Kong and China.

Source: Based on information from VTech company website, available at http://www.vtech.com.

A study of entrepreneurship in Hong Kong for 2004 indicated that only 3 per cent of the adult population have recently started businesses, which is a lower total entrepreneurship activity than is observed for countries in the same income bracket (Global Entrepreneurship Monitor, 2004). Furthermore, the new firms surveyed in the study were primarily exploiting existing technology instead of taking the risk of technological innovation. Most Hong Kong firms thus emphasize entrepreneurial learning and imitative strategies, seeking to exploit new market opportunities through flexible and fast reengineering of production networks rather than R&D-intensive product innovation (Yu, 2004).

However, large business groups in Hong Kong also provide a basis for new, technology-intensive ventures. Property developers who accumulated vast capital resources during the speculative real-estate boom of the 1990s have lately entered advanced technology sectors such as telecommunications and biotechnology. For example, the Cheung Kong Group, led by one

BOX 6.2 CK LIFE SCIENCES – A BIOTECHNOLOGY VENTURE

CK Life Sciences, listed on the Growth Enterprise Market of the Stock Exchange of Hong Kong in July 2002, is engaged in identifying needs and developing revolutionary biotechnology solutions for the improvement of human health and environmental sustainability. The group offers a range of environmentally friendly fertilizers that successfully improve crop yields comparably with chemical fertilizers, whilst also minimizing pollution to rivers, lakes and coastal reefs. A range of bioremediation products have also been developed to tackle pollutants. In the pipeline are a series of animal feed additives that address global concerns about the heavy use of growth hormones and antibiotics in intensive animal-rearing. In addition, the group is developing pharmaceutical applications for treatment of cancer and AIDS.

Proprietary protection for CK Life Sciences' products, processes and know-how is key to the business and more than 100 product applications have been developed. CK Life Sciences' Intellectual Property portfolio consists of some already approved patents with many others being at different stages in the rigorous patent process in the United States or in other countries through the Patent Cooperation Treaty process.

Source: Based on information from CK Life Sciences company website, available at http://www.ck-lifesciences.com.

of Hong Kong's most famous tycoons, Li Ka Shing, has diversified from property development into mobile communications (Hutchison) and Internet and media (Tom.com). It is also a key shareholder in CK Life Sciences, a biotechnology company led by Li Ka Shing's son Victor Li Tzar Kuoi (see Box 6.2).

The most important public organization for policy making related to innovation is no doubt ITC, established in 1999. Due to the history of various government initiatives, however, there are still a number of other policy-making bureaux connected with innovation, including the Commerce, Industry and Technology Bureau (CITB), the Financial Services Branch (for financial innovations), and to a lesser extent regulatory bodies such as the Telecommunications Authority or the Television and Entertainment Licensing Authority. These organizations are not formally connected in

terms of their functions and missions, and since implementation of innovation policy takes place primarily through semi-public organizations such as the Hong Kong Science and Technology Parks Corporation (HKSTP) or the Hong Kong Cyberport Management Company Limited, there is considerable scope for overlap and fragmentation, as we shall discuss in Section 7.2.

4.3.2 Networking, interactive learning and knowledge integration

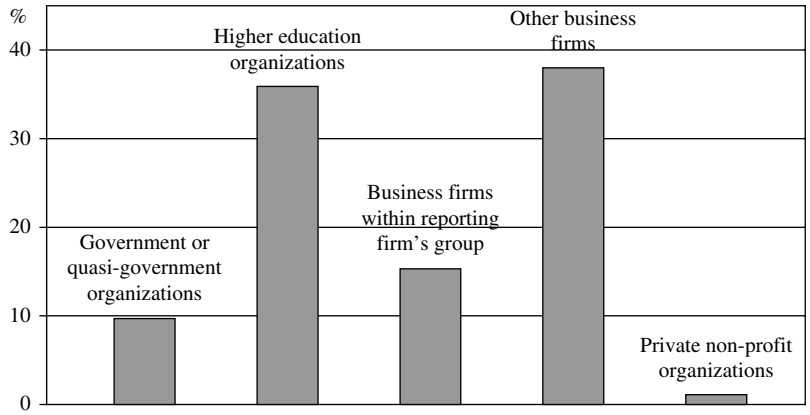
The most prominent aspect of networking among actors in Hong Kong has been the successful development of international subcontracting for industrial firms. During the decades of industrialization from the 1960s through the 1980s, Hong Kong firms were able to learn and upgrade technology through their linkages with customers in the USA, Europe and Japan. Since the 1980s, these networks have been significantly extended to the PRD and other areas in the Chinese mainland.

With the expansion of local tertiary education in the early 1990s, universities sought to extend their cooperation with business firms in Hong Kong. This trend emerged with the establishment of the Hong Kong University of Science and Technology (HKUST) in 1991, but more recently all Hong Kong universities have started expanding their networks both inside their own universities and to other organizations overseas. Lately, this source of R&D cooperation partnership has been complemented by the creation of public research organizations such as the Applied Science and Technology Research Institute (ASTRI), established in 2003. For example, a photonics packaging technology from ASTRI has been commercialized in collaboration with a company called SAE Magnetics. ASTRI is expected to pursue further collaboration with other private firms.

Collaboration and interactive learning occurred among only 14.2 per cent of the private Hong Kong firms engaged in innovation surveyed by the Census and Statistics Department in 2003.[6] As shown in Figure 6.2, most of the R&D collaboration activities were directed at other business firms either within or outside enterprise groups. The higher education organizations were also popular partners in R&D cooperation, while other government organizations accounted for only a small proportion.

The same survey also revealed that firms considered cooperation with suppliers of equipment, customers and competitors as the most important sources of knowledge for technological innovation (see Table 6.7).

Through policies adopted by the Hong Kong government after 1998, attempts have been made to enhance cooperation and networking for technological innovation. For example, the University–Industry Collaboration Programme (UICP), created as part of the ITF, aims to expand network creation between universities and industries. Currently 49 projects in the Teaching Company Scheme, three projects in the Industrial Research Chair



Source: HKSAR Census and Statistics Department (2003b, Table 2.9).

Figure 6.2 Cooperation arrangements related to R&D, 2002

Table 6.7 Top five sources of knowledge or information on technological innovation

Sources of knowledge	% of samples surveyed
Suppliers of equipment, materials, components or software	36
Clients or customers	26
Competitors and other firms of the same industry	18
Within the firm	17
Computer-based information networks (e.g. Internet)	14

Source: HKSAR Census and Statistics Department (2003b).

Scheme and 80 projects in the Matching Grant for Joint Research Scheme have been approved under the UICP.[7]

In addition, private firms not involved in UICP will collaborate with foreign organizations to enhance their competitiveness. The well-known local biotechnology firm CK Life Sciences (see Box 6.2 above) will conduct field trials of their eco-fertilizer in various countries through subcontracting networks with public organizations in various countries such as Australia and the USA. This firm is also known to actively seek assistance from universities to develop and test their herbal products. Yet, as we have noted, collaboration between universities and industry within Hong Kong is still very weak.

4.3.3 Provision of institutions

Hong Kong is a small and externally oriented economy that is already open to market competition. The government therefore sees no need to enact an all-embracing competition law. Instead, it has opted to issue a comprehensive competition policy framework through a policy statement and to reinforce this with sector-specific measures.[8]

Most policies and activities concerned with such institutional issues as competition and intellectual property rights are handled by the CITB of the HKSAR government. The CITB includes the Intellectual Property Department (IPD), founded in 1990. IPD aims to maintain and promote creativity and talent in the region, to ensure local awareness of the importance of intellectual property rights and respecting the rights of others and to accommodate the latest developments in technology.[9]

The government's support for patent applications is, on the other hand, administered and assisted by the ITC, also under the CITB. The enforcement of IPR is left to the Customs and Excise Department.

A variety of private services operates under either government-granted franchises that restrict entry or government-imposed schemes of control to regulate profits and prices. These services include telephone and telecommunications, broadcasting, television (terrestrial, satellite and cable), aircraft maintenance, air cargo terminals, air terminals, container terminals, buses and minibuses. Given the existence of franchises in several sectors of the economy, many have called for new legislation related to competition or anti-trust measures. The government has however remained content with regulating competition through sector-specific rules of the game and detailed management of pricing or mergers and acquisitions in each sector, in spite of apparent problems caused by resource allocation inefficiencies due to differences in institutional settings and the contradictory roles performed by regulatory agencies such as the Telecommunications Authority (Lin, 2002).

Before the handover of sovereignty, IPR were protected in Hong Kong mainly following the British model. Only trademarks were subject to local legislation in Hong Kong, whilst the other three branches, namely patent rights, designs and copyrights, depended greatly on acts of Parliament in the UK. Copyright legislation was enacted solely in accordance with the UK Copyright Act 1956.[10]

The patent system in Hong Kong had previously been based on the Registration of Patents Ordinance. This was essentially a re-registration system involving a first registration in the UK. With the transfer of Hong Kong's sovereignty to the PRC on 1 July 1997, Hong Kong has localized its patent law and has introduced its own patent system, a move consistent with its efforts to develop into an innovation hub. The new Patents

Ordinance came into force on 27 June 1997. The ordinance provides for the establishment of an independent patents regime and the granting of both standard and short-term patents.

While the legal provisions for protection of IPR are clear and transparent, their implementation has affected primarily large businesses and public organizations. In contrast, the availability of counterfeit goods and pirated software or films has been difficult to restrict in practice, in part because of the constant flow of counterfeit goods from the Chinese mainland. Police campaigns to eradicate the trade in counterfeit goods tend to be sporadic and ineffective.

4.4 Support Services for Innovating Firms

4.4.1 Incubating activities

The Industry Department Technology Division launched various funding schemes in 1993 to support the development of new industries. These new funding sources were accompanied by the creation of facilities for incubation services for new high-tech firms. After a decade, the various programmes were eventually brought together in an enhanced incubation programme, called the Incu-Tech Programme, in April 2002.

Hong Kong has witnessed significant growth in public incubator activities for more than a decade, including the emergence of independent private incubator activities during the high-tech bubble of 2000–2001. The Hong Kong Institute of Biotechnology Ltd (HKIB) was founded in 1988 with a donation from the Hong Kong Jockey Club Charities Trust as a non-profit but self-financing downstream development centre for biotechnology products. The HKIB was formed to foster a successful biotechnology industry in the Hong Kong SAR through downstream R&D support and provision of an incubator facility for local entrepreneurs, but it has enjoyed only limited success.

Another early initiative was the establishment of the Hong Kong Industrial Technology Centre Corporation (HKITCC) in 1992, which constituted a publicly supported business innovation centre aimed at promoting technology development through three primary functions: technology-based business incubation and accommodation; the provision of technology transfer services; and the provision of product design and development and support services. In a similar vein, the HKSTP was inaugurated on 7 May 2001 to create a comprehensive organization for high-technology incubation in Hong Kong.

The Hong Kong government also launched the Cyberport project in 1999, with the intention to quickly create a strategic cluster of leading IT service companies in Hong Kong. Construction of the Cyberport was

completed in 2004 and provides advanced facilities and office space for firms engaged in telecommunications, multimedia and Internet applications. The project has been controversial, however, and its role in actually incubating new high-technology IT firms has not yet emerged clearly (Baark and So, 2006).

University business incubators also expanded their activities during the 1990s. Currently, five out of eight universities are providing technology business promotion activity. In many respects, these incubating units make it possible to commercialize research results and technologies developed by faculty and graduate students. It is possible to interpret these schemes for support to university-based entrepreneurship as the fundamental thrust of innovation in Hong Kong (Mok, 2005). However, such conjectures remain theoretical rather than actual reality.

The statistical data related to incubator activities in Hong Kong are limited, providing few indicators of qualitative aspects.[11] Table 6.8 illustrates that most of the incubated firms belong to the information technology, telecommunications and electronics sectors.

Note that the data in Table 6.8 refer only to firms that have left the premises of incubator facilities, and do not indicate the actual survival rate for such 'graduated' firms. A spot check of 87 firms listed as graduated from incubator facilities indicated that at least 17 were not listed in current telephone directories, suggesting that they have stopped commercial business. In addition, only three out of 201 GEM-listed (growth enterprise market) companies are graduates of the incubation programme of the former HKITCC or the Incu-Tech Programme. Most high-technology companies launched on the GEM in Hong Kong have originated in Mainland China; a few well-known GEM-listed companies are technology-related spin-off companies of large corporations, such as the above-mentioned CK Life Sciences.

Table 6.8 Cumulative number of graduated companies since 1992 and number of incubatees in incubation programme, 2004

	No. of incubatees 2004	No. of incubated companies
Biotechnology	4	0
IT & telecommunications	29	74
Electronics	41	12
Precision engineering	2	0
Others	2	1

Source: Compiled from Incu-Tech Programme website.

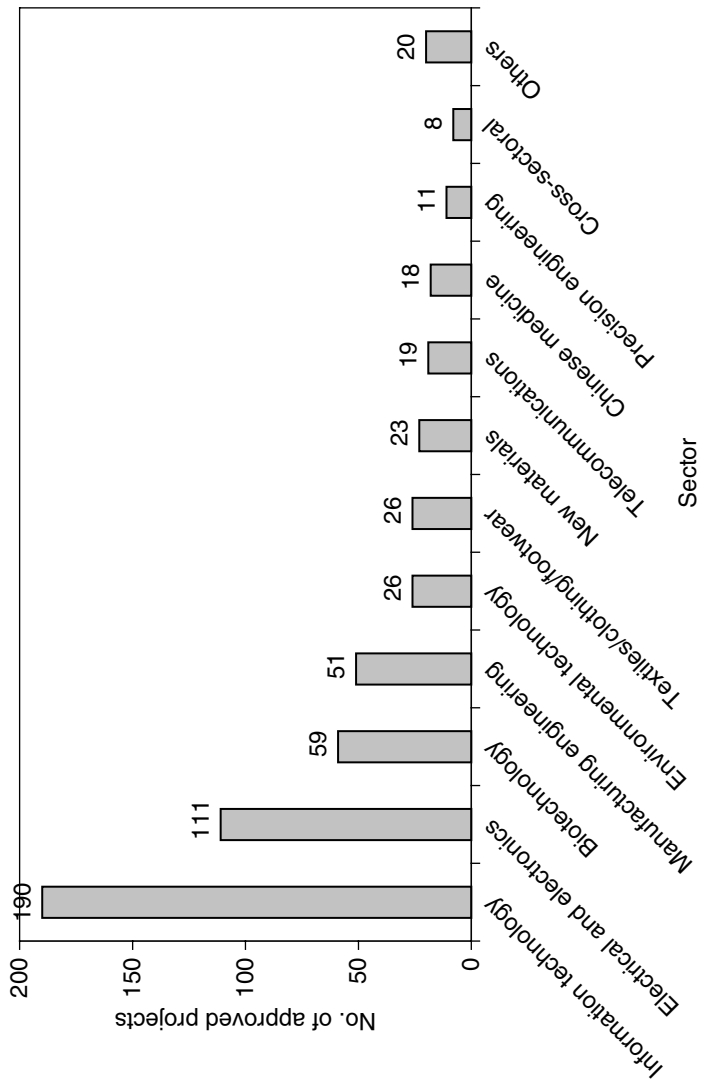
4.4.2 Financing

The lack of appropriate financing sources was identified as a major bottleneck for Hong Kong firms and the most serious obstacle to innovation, with 47.4 per cent of respondents in the 2002 innovation survey citing this as a major hindrance.[12] Recent attempts by the government to improve the situation include co-financing R&D activities through the HK$5 billion ITF and financing investment and venture business through the ARF. By the end of 2003, ITF had supported more than 500 projects at a total funding of HK$1.53 billion. Most of the funding had gone to support technological development in the information technology and electronics industries (see Figure 6.3).

Among the parameters for assessing the impact of the ITF is the level of private sector contributions to R&D activities. Before 1999, the average annual level of industrial support funding and services support funding provided was HK$295 million, with private sector contributions amounting to about HK$24 million per annum. Following the establishment of the ITF in 1999, the average annual amount of ITF funding provided grew to HK$375 million. Since the launch of the ITF, the total amount of private sector contribution has increased to an average of HK$177 million per year (HKSAR, 2004). By and large, the ITF has not yet been instrumental in promoting diversification among property developers to invest in high technology (as discussed in Section 4.3.1). Rather, ITF funding has in large part been allocated to individual university researchers and specialized industry organizations (personal interview with Science Adviser to the Innovation and Technology Commission conducted on 23 August 2004).

The ARF is a government-owned venture capital fund formed to provide funding support to technology ventures and R&D projects that have commercial potential. The ARF has a capital endowment of HK$750 million. It is administered by the Applied Research Council, which appointed two private sector venture capital firms to manage the investment of funds from the ARF in November 1998. As of the end of March 2004, the ARF had supported 23 projects with approved funding of HK$387 million. Most of these projects hade been in information technology (60 per cent) and telecommunications (28 per cent), while electronics (9 per cent) and biotechnology received much smaller shares. However, the poor performance of investments and lack of significant impact on new high-technology entrepreneurship in Hong Kong caused a decision by the governing board of ARF to cease investment in new projects in 2005 (Legco, 2005).

According to the findings of a recent survey commissioned by the ITC, each ITF project has on average generated 1.3 technologies or products, 0.55 patents have been filed per project and 0.15 patents per project have already been granted (HKSAR, 2004). However, as the ITF has been



Source: HKSAR (2004).

Figure 6.3 Sectoral breakdown of the 562 approved ITF projects (involving a total funding of HK$1.53 billion as at 31 March 2004)

based largely on a bottom-up approach (initiated mainly by individual researchers and research groups), it has not proved conducive to building significant focus and clusters. After reviewing the existing innovation and technology programme, the government proposed in June 2004 to adopt a new strategy of innovation and technology development (see Section 7.3).

4.4.3 Provision of consultancy services

Given the importance of service industries in Hong Kong's economy, the availability of consultancy services represents a significant input into the NSI. Both public and private consultancy services have flourished during recent decades, and the role of foreign consultancy services is also important. Many services are related to trade with the Chinese market, but there are also a number of actors involved in providing consulting services related to technical innovation or management; the information in this section concerns such services.

The most important public organization providing consultancy is the Hong Kong Productivity Council (HKPC), which was established in 1967 to promote increased productivity and the use of more efficient methods across Hong Kong's business sectors. HKPC and its subsidiary companies employ about 600 highly skilled consultants and staff, providing a multitude of services to over 4000 companies each year. The HKPC has been expanding its service income gradually to an annual rate of HK$555 million in 2002–3, of which approximately HK$155 million came from government subsidy. The income from fees charged for services was HK$396 million in 2002–3, up from HK$287 million in 1998–99 (Hong Kong Productivity Council, 2003).

Research centres and individual faculty members at universities in Hong Kong also provide consultancy services for technological development and innovation. An important initiative for increasing the utilization of technical consulting services from universities in Hong Kong has been the UICP operating under the ITF, which distributed HK$7.3 million to 113 new and ongoing projects.

The private sector includes consulting engineering firms that primarily offer technical design and supervision services for construction in Hong Kong and on the Chinese mainland. Many of the large engineering service firms are local offices of major international consulting firms (Baark, 2004). The residential building sector was the largest end-use group of engineering services related to construction activities in 2002, followed by transport projects and service/commercial building projects. Virtually all of the world's leading management consulting firms are represented in Hong Kong, attracted by easy access to international skills and technology, a pool of experienced consultants, a rich client base and proximity to

the mainland market. Together with other professional services such as accounting, insurance and financial services, management consultants form a vital component of KIBS in Hong Kong. As we have noted in Section 3, this sector has the highest propensity to innovate and it is also providing crucial inputs to other less innovative sectors of the economy.

The reliability and quality of such services have been generally recognized in the region by local and multinational firms operating in China, often using consulting services from Hong Kong firms, despite the higher fees charged by Hong Kong consultants.

4.5 Summary of the Main Activities Influencing Innovation

One may say that Hong Kong SAR's NSI is weak and emergent, with a low level of investments in R&D (0.69 per cent of GDP) and innovation. Given the very recent and incremental nature of the Hong Kong government's promotion of innovation, the influence of institutions as well as public organizations in Hong Kong's NSI has not yet reached significant levels. This is without doubt a legacy of Hong Kong's historical role as a trade hub coupled with low levels of government intervention.

Among the unique assets of Hong Kong's NSI is its innovation-oriented higher education sector (see Sections 4.1.1 and 4.1.2). The quality of university research in Hong Kong compares very favourably with respect to its neighbours in the region (as indicated by research output) (see Table 6.4), although recently proposed budget cuts have yet to take their effect on this part of the system. Increasing interaction with industry (in terms of technology and research transfer) has marked an important policy-initiated trend in this area over the past few years, as has increased emphasis on formal and informal integration measures with businesses and institutions in the PRD region.

In firms, R&D and innovation have been increasing over the past several years (see Table 6.3). This is due in large part to recent government initiatives. As Hong Kong firms face limits to profit maximization through cost reduction, they are increasingly looking towards innovation and R&D as a driver of future profits. Combined with the incentives the government is providing, it is expected that business R&D expenditures will continue to rise over the coming decade.

5 CONSEQUENCES OF INNOVATIONS

Science and technology did not play a large or formal role in Hong Kong's NSI until well into the mid-1990s. The colonial government, mostly

concerned with Hong Kong's status as a trading hub, for the most part neglected formal innovative activity, research, development and investment directed towards the generation and commercialization of new knowledge (Parayil and Sreekumar, 2004). Hong Kong's economy nevertheless grew dramatically by cutting factor costs and developing organizational innovations (in particular non-R&D-based organizational innovations in firms).

The main thrust towards technological change in Hong Kong before the late 1990s was concentrated on improving productivity and the quality of products. Industry had remained competitive primarily by lowering costs through moving production to the PRD region in southern China and undertaking organizational innovations. As Hong Kong's economy moved away from assembly operations to higher value-added production, a constant flow of creatively applied technology was essential to stay ahead in competitive global markets. In other words, the key strategy for the last three decades has been to exploit technological knowledge and advanced equipment from overseas sources and to utilize such inputs together with organizational innovation to create flexible, low-cost production systems. The expansion of the higher education sector and the development of vocational training in Hong Kong have aimed to further improve the absorptive capacity in industry and services.

These efforts raised TFP in the Hong Kong economy by an average annual growth rate of 0.86 per cent during the two decades from 1981 to 2000. Yet while Hong Kong experienced high productivity growth in the second half of the 1980s, the rate of growth declined considerably in the 1990s. This is also the picture shown by figures reported in Appendix Table A2.2, which indicate that labour productivity growth in Hong Kong during 1995–2002 was 1.4 per cent. In the period 1996–2000, when the Asian financial crisis set in, Hong Kong actually achieved a negative contribution of TFP to output growth of −0.89, as shown in Table 6.9. The table also indicates that the development of TFP varied not only in terms of time periods but also between various sectors of the economy.

Li (2002) shows in particular that the tradable goods industries located in Hong Kong contributed directly to the GDP at an annual growth rate of 5 per cent in TFP during the period 1983–2000. Tradable services (including import/export trade, transport, storage, financial and business services) contributed at a lower TFP rate but remained positive at an average of 0.7 per cent during 1983–2000 and improved their TFP growth rate during the 1990s. In contrast, the non-tradable services (including construction, electricity, gas and water, communication, real estate and social services) experienced a negative TFP growth of −0.8 per cent during 1983–2000. The differences separating these three sectors of the economy are related primarily to the influence of labour productivity, which experienced stable

Table 6.9 Hong Kong's productivity development: 1981–2000 (% of annual growth rates)

Period	Output growth	Capital growth	Labour growth	Contribution to output growth		
				Total factor productivity	Labour	Capital
1981–85	5.25	8.71	2.61	−0.07	1.45	3.88
1986–90	8.04	7.50	1.11	3.98	0.60	3.46
1991–95	4.97	8.45	1.17	0.38	0.62	3.97
1996–2000	3.15	6.18	2.40	−0.89	1.36	2.68
1981–2000	5.34	7.71	1.82	0.86	1.00	3.49

Source: Based on Li (2002, Table 3, p. 7).

improvement in the tradable goods sector during the last two decades and rose in tradable services during the late 1990s, while labour productivity in non-tradable services actually declined slightly in the late 1980s and remained stable in the 1990s.

While innovation and new technology are likely to have contributed to the growth in TFP in tradable goods and services, productivity growth rates in these sectors have stagnated lately, and this problem indicates the need for further development and diffusion of technology. Such low productivity in non-tradable services is related to the lack of competition in several public utility sectors and a huge rise in speculative activities in real-estate services during recent decades. This latter phenomenon has created the illusion of economic growth without much value-added or technological input. Further exacerbating the problem, the availability of low-cost labour to manufacturers that moved to the Chinese mainland has discouraged investment in technological change and productivity improvement (Kwong, 1997). These factors continue to pose a threat to the competitiveness of Hong Kong's industries and services, and they constitute important reasons for the government's recent concern with improvement of innovative capabilities.

6 GLOBALIZATION

There is no doubt that Hong Kong is closely integrated in the international economic system and that globalization therefore has had a significant impact on the NSI in Hong Kong. Because of its pre-1997 colonial status, Hong Kong's development was linked to the policies of the UK, and with

an open economy actors in Hong Kong sought opportunities in the international market. Since the return to Chinese sovereignty, the Hong Kong government has also consistently supported foreign direct investment in the territory and successfully made it a key priority to create a business environment that would encourage transnational corporations to set up regional headquarters in Hong Kong. Consequently, the number of overseas firms that have established their regional headquarters in Hong Kong grew from 602 in 1991 to 1167 in 2003, while overseas firms with regional offices in Hong Kong grew from 278 to 3798 during the same period (Hong Kong Trade Development Council, 2006).

Most of these firms hope to exploit Hong Kong's position in the growing Chinese market, and the major part of their activity is concerned with managing global production or supply chains. The rapidly expanding services located in Hong Kong are also serving global networks of production or trade. However, few transnational corporations have located significant R&D functions in Hong Kong, preferring instead to focus their overseas expansion of R&D on locations in the Chinese mainland. Meanwhile, foreign companies are setting up more R&D centres and service departments to serve the Chinese market, which has become a major market as well as a manufacturing base. Foreign investors had set up over 600 R&D centres in China as of June 2004, with a total investment of US$4 billion.[13]

The integration of Hong Kong into the economic system of China has further enhanced the trend in its economy towards globalization. At the same time, Hong Kong firms are actively seeking to extend their innovative networks in both the Chinese mainland and more advanced centres in industrialized countries. A recent survey of R&D in Hong Kong and the mainland indicates that many firms in Hong Kong were carrying out R&D in both Hong Kong and the PRD. Based on the information supplied by 229 firms (49 per cent of the sample of firms operating in both Hong Kong and the mainland), it was clear that the outsourcing of R&D and investments in R&D beyond the borders of Hong Kong were very significant.

As of 2003, only 17 per cent of the total R&D staff in Hong Kong firms were working in R&D units located in Hong Kong, while 53 per cent were employed in Guangdong Province, 3 per cent in the Yangtze River Delta, 19 per cent in other mainland provinces and 8 per cent overseas (Federation of Hong Kong Industries, 2003). The primary reasons for locating R&D on the mainland is the supply of talent and research facilities, while research costs rank only third. The majority of firms with mainland operations surveyed (78 per cent) indicated that they planned to continue or expand their R&D efforts, and almost half (46 per cent) planned to recruit more R&D staff in Guangdong. Only 13 per cent had plans to recruit more R&D staff in Hong Kong. Given the substantial R&D activity undertaken

in Guangdong by Hong Kong firms, figures for the Hong Kong R&D expenditure probably understate the total R&D effort made by these firms.

Hong Kong government policies are oriented towards enhancing the global linkages of firms and organizations located in Hong Kong, while at the same time encouraging innovative overseas firms to move advanced R&D functions to the territory. Such a strategy is one that the Irish NSI has pursued with success, whereby technology transfer from abroad – particularly from US companies – has contributed to the technological levels of the Irish system more than its indigenous local capabilities (see Chapter 5, this volume). Both the CyberPort and the Hong Kong Science Park initiatives clearly aim to attract high-technology firms. Such a policy presents no contradictions to the government since it sees the location of advanced high-technology activities in Hong Kong – regardless of the origin of ownership of the organization – as a substantial benefit.

7 STRENGTHS AND WEAKNESSES OF THE SYSTEM AND INNOVATION POLICIES

7.1 Strengths and Weaknesses

Our analysis so far suggests that Hong Kong has a weak NSI, particularly if innovation is defined rather narrowly in terms of knowledge creation through R&D inputs and patentable technology as output. This weakness is chiefly a result of Hong Kong's historical place as a trade hub *vis-à-vis* China. The Hong Kong experience also demonstrates, however, how important it is to call attention to the exploitation of existing knowledge, emphasizing the use of existing technology transferred from abroad supplemented with many non-technological innovations. Hong Kong's NSI is able to absorb proven technology and carry out incremental improvements in products and especially production or organization processes that can provide competitive assets in terms of cost and flexibility of supply to global markets, as we have documented in Section 3. These assets in turn depend on the capacity of Hong Kong firms to organize or service global production chains deeply integrated in the Greater China region.

In this regard, Hong Kong has been most successful, and it is to this experience that Hong Kong can attribute much of its historical prosperity. By occupying the role of a trade hub, Hong Kong has amassed considerable experience in terms of exploiting existing knowledge for its own benefit. This experience has been successfully utilized to situate Hong Kong as a nexus of trade between Mainland China and the rest of the world. Hong Kong can continue to prosper by making use of the knowledge

embodied in the capabilities it has as a trading centre, by transferring that knowledge and those capabilities to the innovation domain – that is, transforming itself into an innovation hub.

These strengths of Hong Kong's innovative efforts are most clearly observed in a few specialized low-tech sectors such as textile or garment products, watches and telephone handsets. They also characterize service sectors that have become prominent during the last couple of decades, such as financial services, logistics and management consulting and accounting services. A particular illustration of the ability to use innovative organization and networks to orchestrate global production chains is provided by the Hong Kong-based firm Li & Fung, described in Box 6.3. Such skills can be transferred effectively to the area of high-tech or innovation-intensive products. Institutions resting on fundamental market-oriented development in such areas as improved technical safety requirements or intellectual property protection, created during the last two decades, are acting to support these strengths in Hong Kong's NSI.

BOX 6.3 LI & FUNG – INNOVATIVE ORCHESTRATION SERVICES

One firm that has gained considerable fame on the basis of its high level of competitiveness in innovative services is Li & Fung, a Hong Kong trading company established in Canton in 1906 with sales amounting to US$4.2 billion in 2001. Li & Fung has developed a specialized role as the orchestrator of loosely coupled supply chain processes for a range of consumer products requiring labour-intensive manufacturing. Supplying well-known clients, like Levi Strauss, Reebok and Disney, the firm uses a wide network of more than 7 500 suppliers in Asia and other continents to meet specific product needs, providing service along the entire chain of production through delivery of products to end customers – often packaged and marked with a price to be put directly on the shelf. This is achieved with the assistance of a hybrid organization that includes a highly advanced and sophisticated electronic trading system linking 5000 people supervising the manufacturing process and various clients globally (Brown et al., 2002).

At the same time Li & Fung utilizes more traditional networks of personal contacts and supervision to ensure quality assessment and on-time deliveries. This extensive network of human resources coexists with the information technology infrastructure to handle detailed design, production scheduling, logistics, final assembly

and customer relations. A dedicated team is engaged in extremely knowledge-intensive 'disintegration' and optimization of supply chains, carrying out design and planning of distributed manufacturing and coordination of the vast network. But few of these activities require formal R&D and innovation is integrated into the development of new business processes and products. It is its specialized expertise in supply chain management that provides Li & Fung with its unique competitiveness in global markets.

Source: Based on information from Li & Fung company website, available at http://www.lifung.com/eng/global/home.php and Brown et al. (2002).

It is, however, also evident that weaknesses in the systems and organizations formed for the creation of new knowledge – requiring R&D-intensive development of products and services – pose a critical challenge to future economic development in the territory. After a decade of investment in higher education, universities in Hong Kong have upgraded research facilities and capabilities and are also trying to extend their networks to private industry and service sectors in order to commercialize potential new technologies. The university sector is likely to be the main public actor in the NSI even if current initiatives increase the number of government-sponsored research institutes serving specific sectors. We also observe that an increasing source of input for innovation in Hong Kong could be R&D carried out in organizations on the Chinese mainland. Maintaining crucial linkages to global networks, Hong Kong firms will be increasingly able to leverage their access to China's growing resources for innovation and thereby compensate for the relative weakness of local R&D organizations.

7.2 Summary and Evaluation of the Innovation Policy Pursued

In evaluating past innovation policies in Hong Kong, the most conspicuous point to be made is how 'late' the policies have been in their introduction. Not until 1999 did Hong Kong develop any kind of formal, coordinated innovation policy. Against almost any comparative benchmark – that of OECD countries, Asian tiger economies or countries of a similar size – that is far too late. Compare this with Singapore where, before 1990, the policy focus had been on promoting technology deployment while after 1990 the government shifted its attention to raising the indigenous R&D profile of local Singaporean companies through various long-term strategies and plans. In Hong Kong's case this delay may have been especially detrimental to the overall NSI because of the speed and intensity with

which the PRC – the one economy on which Hong Kong uniquely depends for its economic livelihood – has been opening since 1979.

Lateness in tackling and introducing innovation policy and subsequently weak implementation have left many initiatives fragmented and ineffectual. Hong Kong could therefore benefit from an approach to its NSI whereby policy initiatives are better coordinated and understood in terms of a larger conceptualizing framework – the NSI approach. Indeed, in the latest government publication (see, e.g., HKSAR Innovation and Technology Commission, 2004) policy makers have explicitly integrated the SI approach as an aid to overall policy discussion and implementation. The moves towards adopting a system of innovation approach by the Hong Kong government must, however, be tempered by the observation that steps towards greater coordination and integration among the constituent elements of Hong Kong's NSI are in their infancy. There is a long way to go. The fear in Hong Kong remains that such bureaucratic changes may, ultimately, come too late to make a positive difference. The consensus among key policy advisers in Hong Kong is that a major weakness in innovation policy making has been a reluctance to address systemic relationships among the different policy areas. This hesitation has been associated with a lack of effective policy coordination. For example, despite the establishment of the ITC in 1999, there are still a number of other policy-making bureaux connected with innovation, including the Commerce, Industry and Trade Bureau, the Financial Services Branch (for financial innovations), and to a lesser extent regulatory bodies such as the Telecommunications Authority and the Television and Entertainment Licensing Authority that are not formally connected in terms of their functions and missions.

7.3 Future Innovation Policy

Hong Kong has made progress in transforming its role from that of an unrivalled trade hub into that of an innovation hub. This change, we argue, is the background for its newly initiated innovation policies and will influence their impact in the future. In mid-2004, the ITC proposed a new strategic framework for innovation and technology development underpinned by five core elements (see Box 6.4).

To implement the new strategy, priority has been given to the production of new knowledge. At the same time, however, the government recognizes the importance of 'leveraging the mainland' in order to become a facilitator or an innovation hub of technology inflows and outflows, particularly to the PRD. These two roles (producer and facilitator) are interconnected and co-evolving, especially as Hong Kong's overall integration (at cultural, economic and technological levels) into China gathers momentum.

BOX 6.4 KEY ELEMENTS UNDERPINNING THE HKSAR GOVERNMENT'S NEW INNOVATION AND TECHNOLOGY FRAMEWORK

(i) Focus: to identify key technology focus areas where HK is deemed to have an advantage for optimal use of resources to create greater impact
(ii) Market relevance: to adopt a demand-led, market-driven approach in driving the innovation and technology programme to ensure that investments are relevant to industry and market needs
(iii) Industry participation: to closely involve the industry in defining the focus areas and in other stages of innovation and technology development
(iv) Leverage the mainland: to utilize the production base in the GPR Delta region as the platform for developing applied R&D and commercialization of applied R&D deliverables
(v) Better coordination: to strengthen coordination among various technology-related institutions and the industry for enhanced synergy and impact

Source: HKSAR (2004).

Still, Hong Kong's role as a trade hub has been in decline and will continue to weaken because of the continuing momentum of China's opening up, which began in 1979, and has resulted in its recent accession to the WTO. The rapid development of Chinese cities such as Shenzhen, Guangdong and Shanghai, whose effectiveness in performing the trade-hub roles Hong Kong has historically monopolized, is coupled with the increasing number of companies able and willing to set up shop directly in China. Only by becoming a facilitator for technology development can Hong Kong take advantage of the skills it acquired as a trading hub, combine them with the basic research capabilities of universities, and apply them in order to become an innovation hub between the PRD and the rest of the world to serve the interests of China's immense and rapidly developing economy.

Through its latest innovation and technology measures, Hong Kong is attempting to upgrade its existing capabilities in nine chosen focus areas. In a number of these areas – such as logistics, textiles and consumer

electronics – Hong Kong can boast a wealth of expertise. In other areas, however, such as automotive parts, Chinese medicine and integrated circuit design, Hong Kong is looking to exploit its 'traditional' role as a facilitator between China and global networks.

Although the proposed set of policy initiatives looks elaborate, the available budget allocation for these measures from the remaining ITF funds (about HK$3.5 billion) is probably insufficient to produce a major turnaround. It is also difficult to predict the actual effectiveness of the R&D centres, which may be physical or 'virtual' centres. A final but significant problem revolves around the issue of developments across the border in southern China. While Hong Kong has made a point of 'leveraging the mainland', there are concerns that it is quickly falling behind. This means that Hong Kong may become isolated unless it acts promptly on its advantages as a hub. As integration with the mainland quickens and deepens, Hong Kong must pay close attention to the qualitative nature of the changes this integration is bringing about. In particular, changes that support the development of innovation-related links with China must be nurtured because of the decreasing importance of its trade-related links with China.

ACKNOWLEDGEMENTS

Research for this chapter was supported by a grant for High Impact Research on Technology Policy (HIA98/99.HSS05). We also wish to thank Charles Man Chi Wai and Raymond Ma Yin Nin for research assistance, and discussants at workshops in Lund, Sweden and Seoul, Korea for their valuable feedback. Any remaining errors are our own responsibility.

NOTES

1. When Hong Kong Island was ceded to the British in perpetuity, it was only a fishing community, inhabited by about 150 000 people and dismissed by the then British Foreign Secretary, Lord Palmerston, as 'a barren rock'.
2. According to Loh (2002), the British seized Hong Kong to serve as a base from which to penetrate China and other Asian nations for trade purposes rather than as new territory for its own sake.
3. Since 2001, the Census and Statistics Department has collected more detailed and systematic information pertaining to R&D, and therefore coverage of business R&D data improved dramatically. This may have contributed to the growth of the BERD figure, although it is likely that the figures reflect a genuine improvement of business investments in R&D following the recent policies promoting innovation.
4. See Post (2003).

5. The speculative nature of property was acutely illustrated in the late 1990s when prices rose dramatically to create a 'property bubble' in which asset prices were artificially high, only for the bubble to burst and result in the slashing of property prices.
6. See HKSAR Census and Statistics Department (2003b). Statistics quoted in this section are derived from this publication.
7. See data available from the Innovation and Technology Commission (http://www.info.gov.hk/itc/eng/funding/arf.shtml), accessed 31 January 2005.
8. See the 'Statement on Competition Policy' (http://www.compag.gov.hk/about/), accessed 24 January 2005.
9. See information on IPR in 'Protecting Intellectual Property Rights in Hong Kong' (http://www.hongkong.org/ehongkong 22/property.htm), accessed 30 August 2004.
10. Tackaberry (1997).
11. The data assembled for this section deal exclusively with activities of incubators, and do not include the general rates of birth and death of firms in the territory.
12. See HKSAR Census and Statistics Department (2003b, Table 3.14).
13. See, e.g., the announcement by the PRC Ministry of Commerce (http://english.mofcom.gov.cn/article/200408/20040800266847_1.xml), accessed 18 August 2004.

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