

**Reinvigorating Hong Kong's Innovation System:
An Overview of Hong Kong Innovation Project**

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Project Overview

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Introduction: The Dangers and Costs of Hong Kong's Positive Non-Intervention

The last decade has witnessed radical changes in the policies Asian economies employ to pursue technological upgrading and diversification. Whereas Japan was once a bastion of techno-nationalist policies for supporting local national champions and keeping foreign multinationals at bay, the last decade has seen Japan open up to investment in its most competitive export sectors, such as autos, and a wave of foreign investment-induced mergers and acquisitions activity. Similarly, Taiwan, where offering lucrative deals to lure the regional headquarters and R&D centres of multinationals was once taboo, has begun avidly wooing multinationals to set up major R&D facilities on the island. In the inverse of Taiwan's moves, Singapore, the base of multinationals in Southeast Asia, has begun to focus on upgrading local small and medium-sized enterprises, which were long neglected by the government. Akin to Singapore's move, Korea has tried to balance its *chaebol*-dominated economy by fostering entrepreneurial activity.

Amidst this frenzy of policy experimentation in East Asian economies with impressive records of technological upgrading, Hong Kong has stood pat despite its lack of technological depth and diversification. Continuing its traditional *laissez-faire* "positive non-intervention" strategy, Hong Kong has been content to rely on its core strengths, such as finance and managerial skills for the Greater China market, while neglecting diversification into other knowledge-intensive¹ industries, particularly those with "hard" technological content. There have always been reasons to question the wisdom of positive non-intervention, but the events of the last six months have made crystal clear the tremendous downside of a strategy that ultimately led Hong Kong to become dangerously dependent on one sector, financial services.

Beyond the lack of diversification in Hong Kong's economy exposed by the financial crisis, continuation of Hong Kong's past *laissez-faire* practices is also dangerous because it is untenable. Some of the advantages upon which Hong Kong's past successes were predicated are quickly disappearing. Hong Kong has served for three decades as a window and entry point into Mainland China for the world's

¹ In this paper, the terms knowledge-intensive and technology-intensive will be used interchangeably as this overview adopts a broader definition of technology to include a wide range of skills than those commonly associated with "high" technology.

companies. What drew companies to use Hong Kong as their staging area into the Mainland Chinese market were Hong Kong's superior infrastructure, strong rule of law and unique managerial expertise combining command of international business practices with deep cultural knowledge of Mainland China's transitional market economy. Today, after decades of investment, the infrastructure and logistical services of Mainland China's ports have come to rival Hong Kong's and Mainland China's urban telecommunications infrastructure is not far behind. Hong Kong's managerial advantage is also under threat. Thousands of experienced educated expatriate Chinese have returned home bringing back state-of-the-art management and technical skills. In addition to this influx of talent, China's universities have improved, expanded and created international linkages, such as joint MBAs with foreign universities, to increase the quality and quantity of the domestic talent pool (Fogel, 2005). Due to these developments, Hong Kong's advantages have dwindled down to just its superior rule of law.

In addition to the looming danger of Hong Kong's loss of competitiveness, Hong Kong's laissez-faire approach to industrial upgrading arguably has had social costs as well. Compared to its East Asian peers, all of which have had much more active industrial upgrading policies, Hong Kong has had the most inequitable distribution of wealth for at least several decades. Furthermore, even as Taiwan and Korea opened up their economies to a significant amount of integration with and outward FDI to Mainland China, they have been able to maintain moderate levels of inequality, while Hong Kong's inequality has gone from bad to worse.

One can see Hong Kong's poor performance on equality very clearly from comparing the Gini coefficients of these four economies over time. The Gini coefficient is a measure of income inequality. It is defined as a ratio with values between 0 and 1, with 0 corresponding to perfect equality and 1 corresponding to perfect inequality. Generally, a Gini coefficient above .4 is considered to be evidence of a large amount of inequality, especially in advanced economies.

Table 1: Inequality in East Asia

Economy	1990 Gini Coefficient	2006 Gini Coefficient
Taiwan	.312	.34 (2005)
Korea	.34 (1989)	.3155 (2004)
Singapore	.436	.472
Hong Kong	.476 (1991)	.533

Sources: Taiwan Statistical Data Book 2002, 2007; *Key Indicators of Developing Asian and Pacific Countries 2007* (Manila: Asian Development Bank, 2007); Department of Statistics, Singapore, 2008; Hong Kong Censtat 2002, 2007.

While Hong Kong has made attempts over the last decade to improve its institutions to promote innovation and a broader based knowledge economy, the outcomes have been modest. Some macro-level data demonstrate this relative lack of progress. Hong Kong's East Asian peers and even much poorer Mainland China have successfully promoted innovation through investment in R&D. Hong Kong has continued to lag far behind them even as it has increased its investment in R&D (Table 2). Furthermore, the larger investments of Hong Kong's neighbours have appeared to pay off in terms of larger innovation output as measured by patents. Over the last two decades, these other Asian economies have witnessed large increases in patenting activity while Hong Kong's patenting remains at very modest levels (Table 3).

Table 2: R&D-intensity in East Asia

Economy	R&D (% of GDP) in 2000	R&D (% of GDP) in 2006
Hong Kong	0.45	.81
Korea	2.68	3.0 (2001)
Taiwan	2.3	2.58
Japan	2.98	3.1 (2001)
Singapore	1.88	2.2 (2002)
China	1.0	1.42

Sources: B. Ritchie (2005), "Coalitional Politics, Economic Reform, and Technological Upgrading in Malaysia," *World Development* Vol. 33, No. 5, p. 753; Shih and Chen, Report #3; P.K. Wong, "The Remaking of Singapore's High-Tech Enterprise Ecosystem," In H. Rowen, M. G. Hancock and W. F. Miller (Eds), *Making IT: The Rise of Asia in High Tech* (Stanford: Stanford University Press, 2007), p. 130; D.B. Fuller and E. Thun (2006), "China's Global Path," *World Business* (July-August), p. 40.

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

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

Source: P.K. Wong, Report #2, Annex Table #3.

The research undertaken by our project team suggests that the macro-level data represents an accurate picture of Hong Kong's lacklustre innovation performance. The project team uncovered a number of deficiencies in Hong Kong's institutions of innovation. The investigations conducted by our project team in various knowledge-

intensive sectors confirm the findings from our investigations of the system-wide institutions.

Essentially, the core problem is a cluster of poorly performing institutions that reinforce each other's inefficiencies. The two main areas of weakness are public funding of R&D and lack of entrepreneurial capital. Hong Kong's public R&D policy has failed to resolve the problem of low levels of investment in technology development, which has led to a continued dearth of quality technology-intensive firms. The absence of such firms has deterred entrepreneurial finance from investing in technology-intensive firms in Hong Kong. In effect, the continued absence of promising technology-intensive firms has confirmed Hong Kong's investment community's bias against funding technology-based start-ups. Even if without bias, investors can rightly conclude that the lack of prior investment in technology development has led to a paucity of promising technology-oriented firms. This reluctance to invest in technology-intensive firms in turn serves to undermine public R&D efforts as public research institutes are left without strong private industry partners with which to collaborate. The rest of the overview will cover the major findings and recommendations for improving Hong Kong's innovation system with special attention paid to Hong Kong's problematic public R&D and entrepreneurial finance.

I. Reforming Hong Kong's Public Sector R&D²

1. Background

Since 1998, a few funding schemes have been set up under the auspices of the Innovation and Technology Commission (ITC) to support different innovation activities, ranging from R&D (the Innovation and Technology Fund; ITF), technology ventures (the Applied Research Fund; ARF³), design (the DesignSmart Initiative), and patent application (the Patent Application Grant; PAG).

The Innovation and Technology Fund (ITF), launched in 1999 with an injection of HK\$5 billion, is one of the largest funding schemes and aims to support projects that contribute to innovation and technology upgrading in industry. The ITF can be considered as the flagship R&D initiative funded by the Hong Kong government not only because of the large size of its budget but also the wide coverage of its funding structure. The ITF has four programmes: Innovation and Technology Support Programme (ITSP), University-Industry Collaboration Programme (UICP), General Support Programme (GSP), and Small Entrepreneur Research Assistance Programme (SERAP). Of particular relevance to this report is the Innovation and Technology Support Programme (ITSP) because the lion's share of the research institutes' funding comes from this programme. In addition, according to the ITC (2008), the amount approved under the ITSP amounted to 83% of the whole ITF from its initiation to May 2008.

The ITC has adopted a new three-tier structure for funding proposals under the ITSP since 2005. Tier 1 involves the establishment of R&D centres to undertake projects in their respective technology areas. The areas of research are: 1. automotive parts and accessory systems, 2. logistics and supply chain management enabling technologies, 3. textile and clothing, 4. nanotechnology and advanced materials, 5. information and communications technologies, and 6. Chinese medicine. Tier 2 involves the funding of project proposals submitted under the Guangdong-Hong Kong

² This section draws directly from Report#3 by Chintay Shih and Shin-Horng Chen with some modifications.

³ The investment period of the Applied Research Fund expired in March 2005 and the Fund has ceased making new investments.

Technology Cooperation Funding Scheme (TCFS). Tier 3 involves the funding of more forward-looking and innovative R&D projects.

The new strategy launched in 2005 consisted of two key initiatives that resulted in the R&D Centre Programme. The first initiative was to identify the strategic technological areas to be actively promoted by the government. Technological areas had to meet four criteria to be selected: (1) the existence of relevant research capabilities of universities and other research institutes, (2) fit with Hong Kong companies' competitive advantages, (3) industrial needs, and (4) market potential.

The second initiative was to set up R&D centres in selected areas to conduct applied R&D and to facilitate technology transfer from universities and research institutes to the business sector. The underlying criteria were to support the further development of innovation and technology with emphasis on five key elements: focus, market relevance, industry participation, leveraging the advantages of Mainland China, and better coordination among different elements of the innovation and technology programme. In total, five R&D centres were established in 2006 to drive and coordinate R&D efforts in the designated technology areas.

The six⁴ R&D centres are administrated by different host organizations. The designated functions for these centres include: (1) to conduct industry-oriented research; (2) to facilitate IP commercialisation; (3) to provide technology and market intelligence; (4) to provide a platform for exchange of IT/technology; and (5) to promote technology development, transfer and knowledge dissemination. However, according to our interviews in Hong Kong, at least some of the centres resemble project offices, with limited in-house R&D capacity and a limited number of staff members.

Advanced Science and Technology Research Institute (ASTRI) was established in 2000 to conduct industry-oriented applied R&D and was modelled explicitly on Taiwan's Industrial Technology Research Institute (ITRI) as well as other government supported research institutes. ASTRI's research areas include photonics technologies, internet applications, wireless communications and IC design.

⁴ The six R&D centres include an existing one, the Hong Kong Jockey Club Institute of Chinese Medicine Limited, plus five new ones.

Its operating strategy is to transfer the technologies developed from its R&D projects to industry through licensing arrangements, contract research arrangements and spinning-off new technology companies. ASTRI runs the R&D centre on information and communications technology, which is the most active of the six R&D centres.

ASTRI also has a subsidiary company, the Hong Kong Jockey Club Institute of Chinese Medicine Limited (HKJCICM), which aims to promote and support the modernization and further development of Chinese medicine in Hong Kong. The Hong Kong Jockey Club Charities Trust, which owns 50% of HKJCICM, has pledged to donate HK\$ 500 million to fund the R&D activities managed by the HKJCICM, while ASTRI provides office space and supporting facilities for HKJCICM and funds its operating costs.

2. Hong Kong's Public R&D Deficiencies

R&D investment and R&D intensity of Hong Kong is quite low by international standards and compared to its peer economies, with its R&D intensity being as low as 0.81%. Despite a publicised commitment by the government to step up R&D activities, the R&D expenditure invested by the government has been essentially flat as a percentage of GDP (0.02%) over the past several years for which data is available (2002-2006).

More problematic is the way in which the government has allocated the R&D funds. The allocation of public R&D in Hong Kong is intrinsically focused on the short term. The project durations are short. On top of this, the government stresses the importance of generating positive returns from publicly funded R&D over relatively short periods of time. Some attribute this bias to the legacy of British colonial rule when Hong Kong's bureaucrats were expected to keep costs down in order for Hong Kong's colonial government to be self-sufficient financially. Thus, Hong Kong's public R&D lacks long-term, integrated R&D and innovation initiatives. Even ASTRI, the flagship research institute, is mainly doing development work rather than genuinely forward-looking research because of the short time spans of its projects. In addition, not all of the R&D centres supported by the ITSP are truly engaged in R&D activities, with some of the centres functioning simply as project

offices. As a result, the R&D Centres Programme remains a reactive source of funding, even though the R&D centres currently have five years of funding.

An important lesson from the OECD member countries is that “budgetary practices often promote short-term thinking and in some cases undermine strategic, long-term policy making (OECD, 2005, p.8).” As a result, efforts have been made in OECD countries to reduce fragmentation and create critical mass and concomitant excellence in the public research sector. Initiatives in this area include ensuring or strengthening block grant funding mechanisms to support longer-term research, especially in developing economies, and renewing support for infrastructure and research equipment in more advanced countries (OECD, 2008, p.59).

One country worthy of emulation is Finland. The Finnish government has improved upon the centres of excellence model by supporting a few Strategic Centres for Science, Technology and Innovation (known by the Finnish acronym SHOKs). SHOKs provide a new way of coordinating dispersed research resources to meet targets that are important for Finnish business and society. In the individual strategic centres, companies, universities and research institutes work together to formulate a research plan. These plans aim to meet the practical application needs of member companies within a five-to-ten-year period. In addition to shareholders, public funding organisations commit themselves to providing funding for the centres over the long term. Another good example is Singapore’s “holistic” approach to the development of a leading centre of excellence in biotechnology, which does not just involve funding initiatives but requires a good combination of vertical and horizontal programmes for strategic areas (Vonortas, 2008).

It is imperative for public R&D in Hong Kong to have a more balanced R&D portfolio with a certain portion of public R&D investment in long-term strategic topics, such as new architectures, systems and business models. However, for this kind of R&D activity to take root in Hong Kong, particularly within research institutes, a more flexible governance relationship between funding agencies and research institutes is required.

Though funded by different schemes, nearly all research institutes in Hong Kong are positioned to conduct industry-oriented applied research. The problem is that the funding schemes administered by the ITC are short term-oriented, dispersed

and reactive, as discussed above. As a result, the research institutes are deficient in their R&D portfolio and short of capital for making strategic investment. Taking ASTRI as an example, its research projects are supposed to meet three conflicting criteria simultaneously: to be innovative, to have commercial value and to be completed in 18 months or less. As a result, ASTRI tends to be constrained to pursuing development work and me-too projects. This is compounded by the ITC's requirement of a 10 % private industrial contribution for each project because the business sector in Hong Kong generally has a strong preference for short-term return on investment.

In contrast, ITRI in Taiwan, with financial support from the Department of Industrial Technology (DoIT) at the Ministry of Economic Affairs (MOEA), can propose and conduct long-term R&D projects of up to four or five years although annual reviews for checking progress are still conducted. In addition, DoIT's funding schemes for research institutes provide the latter with opportunities to conduct different types of research and/or strategic investment, ranging from pioneering technology research to the development of large-scale R&D facilities and industrial infrastructure in order to meet their long-term strategic needs. More importantly, the assessment procedures can vary across different types of funding schemes. In particular, the assessment procedure for the Pioneering Technology Research Program is conducted by the ITRI itself in order to provide the appropriate space and flexibility for the formation of more creative projects.

For R&D schemes under the ITF, the ITC explicitly requires industrial sponsorship for each project⁵ of not less than 10% of the total project cost, with an aim to ensure that projects are industry-oriented. On the one hand, local professionals, particularly those in R&D centres and universities, consider this requirement troublesome and rigid. On the other hand, according to ASTRI, the ITC has shown some flexibility by allowing ASTRI to get an average of 10% from a number of projects rather than a full 10% for each project. In our views, the industrial sponsorship requirement may not be so unreasonable, but the problem is that the ITC's R&D funding schemes for research institutes are not as diversified as DoIT's are in Taiwan. In order for the research institutes to have a sound and balanced R&D

⁵ There has been a small group of projects for which no external funding is required.

portfolio with more forward-looking research, we suggest that the ITC provide a wider variety of R&D schemes for the research institutes. Some of the schemes could still demand industrial sponsorship while others could allow the research institutes to pursue strategic R&D even without participation from private industry.

The approval process for projects is time consuming and complicated. Moreover, research proposals have to go through five panels, including internal review, industrial review, technology review, the ITC and the board of directors. Additional approval from the Finance Committee of the Legislative Council (LegCo) is required for projects requesting more than HK\$21 million from the ITF. The financial ceiling was increased from HK\$15 million to HK\$21 million only in October 2008. This process is too long and often costs the projects time-to-market lead time.

Related to the review process, ITC's project management is often criticized. There is the impression that the ITC tends not to tolerate any changes in the projects. Output from R&D projects need to be specified beforehand, especially in terms of what patents are to be filed. Any changes in projects require extensive paper work and approval from the ITC. This micromanagement induces rigidity and increases inefficiency in R&D work. It is therefore essential for the ITC to reduce its micromanagement. For example, a broad range of changes in projects should be allowed with approval by the technology review committee alone. Methods of project evaluation must also be reconfigured. Some staff members of the R&D centres are particularly concerned with the criteria used to evaluate their performance. A good counter example to the ITC's administrative meddling is Taiwan's DoIT. DoIT tolerates failures in some cases because it evaluates the performance of research institutes from a long-term perspective, especially in its most forward-looking programme, the Pioneering Technology Research Program.

The way in which the government manages the R&D Centre Programme also merits criticism. Not all of the R&D centres are truly engaged in R&D activities so they simply exist as an additional layer of bureaucracy between the ITC and the researchers. Furthermore, the projects funded by the R&D centres are not that different from those funded by some other major schemes administrated by the ITC.

Finally, the weakness of private enterprise in some of the sectors the R&D Centres are intended to support leads to the centres being of little value in promoting innovation.

Across most of the knowledge-intensive sectors studied by the project team, the scale of public R&D needs to be expanded to provide a sufficient boost for industrial development given the weaknesses of private enterprises, such as their small scale and limited pool of entrepreneurial finance. The current system spreads resources too thinly across various sectors guaranteeing that public R&D has a low positive impact. Hong Kong must decide whether or not it will support R&D at sufficient scale for various technologies. The current method of cautiously releasing relatively small amounts of funds to six sectors results in generally poor results across all of them. In effect, Hong Kong is choosing to lose by refusing to back its various research areas wholeheartedly.

A final issue is about the shortage of dedicated professional technology managers for the promotion of technology transfer on the part of the research institutions as well as the universities. According to ASTRI, its R&D personnel have to shoulder the work of R&D and the promotion of technology transfer at the same time. In Taiwan, not only do research institutes have dedicated units for technology transfer and/or technology management, but DoIT provides the research institutes with the resources required through the Infrastructure-Building Program. It is therefore advisable for the ITC to make similar efforts.

II. Barriers to Entrepreneurial Finance for Knowledge-intensive Firms⁶

Au and White's report (Report #5) reviews the historical roots and evolution of Hong Kong's venture capital (VC) system and related developments in the financial and industrial sectors, and discovers a number of factors that inhibit the effectiveness of VCs in supporting the commercialization of new technology in Hong Kong. This section summarizes these inhibitors and argues that they collectively should be considered as a systemic institutional deficiency that works against investment in technology firms.

1. Governmental and Cultural Context

Hong Kong's business culture tilts towards a short-term trading mentality with a focus on light, low-tech industries. Government policies have been made with banks and traders in mind, and over the years this has helped Hong Kong grow into an international financial centre. Further effective lobbying by the real estate and financial sector has led the government to continue to channel more resources to these sectors and further embed the short-term, quick-return attitude across society. Longer-term investments in R&D and risky innovation are selected against by an investor community with a doubting cynical attitude towards start-ups attempting to develop and commercialize significantly new technology.

In addition to business culture, politics and ideology must also be considered. Changes progress fitfully as the society and the government continue to struggle over whether Hong Kong can deviate from the doctrine of positive non-intervention. So when the government steps in (such as it did with the Applied Research Fund; ARF), micro-management and monitoring practices derived from a trader's mentality or colonial bureaucratic practice, although intended to maintain fairness and accountability, cause in reality more trouble. Some would argue that any governmental attempts to take Hong Kong in a different direction are doomed to fail (Goodstadt, 2005).

⁶ This section draws directly from Report #5 by Au and White with some modifications.

2. Venture Capital and Private Equity Firms

Most venture capitalists have accounting or finance backgrounds and adopt the attitude that “they are out to make money” rather than to nurture technology and new ventures that could have a major impact on an industry or even the world. For them, the easiest way is the best way to make money, and this leads venture capital and private equity (PE) firms to favour late-stage, mezzanine and buyout deals. These deals are more widely available in Hong Kong and less risky while larger in size, and do not use up as much of their time compared to early-stage deals. Indeed, not many VCs have the skills to build a company from scratch because they do not have relevant experience themselves. Furthermore, their finance background biases them to hire others like themselves rather than former entrepreneurs and operational professionals.

3. New Ventures

Many of Hong Kong’s new firms are family businesses. These first-generation entrepreneurs are happy with the local market and business practices. They don’t like transparency, guard their ownership very carefully, and tend to use insiders rather than professional managers, who were not available in the past. These characteristics are found broadly in society, and make it difficult for VCs to invest in and work with these firms.

Some second generations leaders of family businesses and the new generation of entrepreneurs are different. They have a broader worldview and want to expand beyond the local environment. They are more receptive to being transparency and are more likely able to introduce outside professionals and capital. However, a small local market, high costs, lack of advanced technology, scarce start-up capital and a lack of capable entrepreneurial teams make technology ventures more difficult to establish than non-tech ventures in Hong Kong. In sum, although Hong Kong is famous for its entrepreneurial spirit, high-quality technology start-ups are rare. In fact, there is even a concern that Hong Kong’s legendary entrepreneurial spirit is weakening and could easily fade away.

4. Stock Markets

The Hong Kong Stock Exchange welcomes the listing of large corporations (especially those from the Mainland) and has introduced more advanced financial products. These are the basis of its profits and attract large institutional investors, like pension funds, and investment banks. The technology level of potential listees is not an important criterion for them.

5. Banks and Institutional Funds (Pensions, Endowments)

Banks have a strong bias towards lending based on collateral rather than on the soundness of a business idea or the competency of a management team. They do not have the ability to assess such intangible assets and are quite reluctant to provide financing for start-ups and early-stage firms.

Retirement and endowment funds may invest as limited partners in VC or PE funds. Although their investment horizon and objectives would seem to be in line with the classic VC model that nurtures early-stage ventures over a medium- to long-term horizon, their impact in Hong Kong has been minimal due to Hong Kong's version of the "prudent man" rule.⁷ As a result, money goes into and breeds ever larger expansion and buyout funds. To nurture more technology start-ups, the abundant capital "parked" in Hong Kong needs redirection.

6. Angels and Angel Groups

The traditional way to finance new ventures is savings and family capital, in addition to partnerships with friends and co-workers. Those in Hong Kong, however,

⁷ The rapid growth of the US VC industry in recent decades was attributed to several related events (Gompers & Lerner, 2000, p. 8-10), one being the removal of the "prudent man" rule in 1979. It unleashed pension funds to invest in VCs; investment advisors (gatekeepers) arose to advise and facilitate pension funds to invest. "Prudent man" rules require managers of funds to restrict their investment of clients' funds into investments offering reasonable returns and preservation of capital. In effect, prudent man rules prohibit investing in higher risk areas, such as venture capital.

tend to avoid organising themselves into professional groups. Also, there is a lack of awareness of the social behaviours required for angel investing. The small group of cashed-out or retired local technology entrepreneurs have difficulty finding co-investment partners in Hong Kong and as a result they focus their efforts on the Mainland. As a result, they do not fill the 'equity gap' faced by technology entrepreneurs in Hong Kong.

The irony is that in recent years, the local supply of potentially commercializable technology has been increasing. Hong Kong has begun to see the fruits of years of government support of university-based research and incubation programs such as the Hong Kong Science Park's program. However, missing links and mismatched features of the institutional structure, investor cynicism towards technology investment, and a lack of mutual collaboration among key stakeholders (for example, between angel investors and the VC community) have obstructed the emergence of a new paradigm of technology-focused investing. The state of early-stage investment on technology start-ups, by so-called angel investors or informal venture capital (Mason, 2006), is a particularly weak link. The aftermath of these missing linkages may be summarized by the executive director of one international VC firm specializing in investments in technologies developed in universities, which opened its Hong Kong office in 2005, as follows:

The society is innovative and entrepreneurial. The Science Park is great in innovation...But there is not a cohesive financial arrangement, and entrepreneurs, academics, politicians and civil servants lack the appropriate skills to differentiate good ventures from bad. They have to mature in their decision-making to accept risk and how return is generated.

III. Missing in Action: Hong Kong's Expatriate Technologists

Given the problems with securing public funding of corporate research and financing knowledge-intensive start-ups, Hong Kong can be a daunting place to consider setting up such firms. It is thus completely unsurprising that Hong Kong technologists living abroad have little interest in returning to Hong Kong to set up technology-intensive businesses. This lack of expatriates returning from abroad stands in sharp contrast to Hong Kong's neighbours, such as Taiwan and Mainland China, and other economies where "returnees" have fuelled a technology boom (Saxenian, 2006).

These other economies may offer more hospitable environments and business opportunities for technology entrepreneurs that lure returnees home, but some of these economies have also been very proactive at utilizing organizations in the global centres of innovation, such as Silicon Valley, to recruit potential technology entrepreneurs back home and build transnational networks between the co-ethnic technologists at home and abroad. For example, the Taiwanese have used the Monte Jade Association and the Indians have used The Indus Entrepreneurs (TiE) in Silicon Valley for these purposes. As for technologists from Hong Kong, they are more likely to go to Mainland China than Hong Kong because the incentives are better and the Chinese have supportive organizations, such as the Chinese American Semiconductor Professional Association (CASPA), which facilitates moving back to China from Silicon Valley and any technology centres.

IV. Balancing between Hong Kong's Regional, National and Global Links

Hong Kong's business and economic ties operate at several different levels. Hong Kong is a global city, the "dragon head" of the Pearl River Delta (PRD) region and a special administrative region that has served as an entry point into the rest of the People's Republic of China. When designing an innovation strategy for Hong Kong, it is important to keep in mind these different links as policies that foster one may negatively impact another. The strategic imperative for Hong Kong in managing its various orientations is not to choose one at the expense of forsaking any of the others.

Given the pull of China's large market, it is natural that Hong Kong might want to put all its emphasis on being the headquarters of the PRD region or one regional player among many within China. However, such moves could very easily endanger Hong Kong's unique position as the most global of Chinese cities. Furthermore, there is a jockeying for position between municipal and regional governments within the PRD region and regional economic rivalry more broadly within China. Hong Kong must keep in mind that cooperation within the PRD and with the central government should be welcomed, but Hong Kong should not adopt a less self-interested stance than other regions or municipalities in China. Since China's major municipalities and regions are consciously engaging in rivalrous promotion of their own local economies, Hong Kong should act no differently.

This does not mean Hong Kong should not cooperate with others in China, but it must always place foremost consideration on what is good for Hong Kong's economic development. Regional cooperation should be pursued as long as Hong Kong can ensure that cooperative development of the PRD does not come at the expense of Hong Kong's own development. The recommendations will discuss ways to evaluate which mechanisms of cooperation are in Hong Kong's best interest.

V. Hong Kong's Innovation Strengths

It would be churlish to only point out Hong Kong's innovation policy failings. Hong Kong has already laid some of the foundations for a vibrant system of innovation. Hong Kong runs a reasonably good system of tertiary education (see Reports #1 and #4) and educates a reasonable number of technologists from this system although some question the quality of on-the-job training in Hong Kong (see Report #7). The Hong Kong Science and Technology Park provides a broad array of quality, cheap services for its tenants, including the firms within its incubator program (see Reports #5 and #10). The previous poor enforcement of intellectual property rights has improved immensely (Report #2). Finally, the sectoral research (Reports #8 to #13) our team conducted also provides hope through documenting successful local technology-intensive ventures that have prospered in Hong Kong despite its institutional deficiencies.

Nevertheless, in order to guarantee the people of Hong Kong a prosperous future, an extensive overhaul of Hong Kong's institutions of innovation is in order. The final section lays out recommendations to repair the weaknesses and enhance the existing strengths of Hong Kong's system of innovation.

VI. Recommendations

1. Reform of the ITF and Public Funding of R&D

1a. Cut Extraneous Review Panels

The ITC should cut the review process down to one panel, the technology review panel, in order to speed up the approval process dramatically. This measure is especially critical for the short-term development projects.

1b. The HK\$21 million cap above which LegCo approval is needed should be lifted or drastically increased.

1c. The required corporate contribution for projects should not be increased from ten to twelve percent as is rumoured to be under consideration.

1d. More Long-term Research as part of R&D Portfolio

It is imperative for public R&D in Hong Kong to have a more balanced portfolio. Spending a certain portion of the public R&D investment on long-term strategic research is an absolute necessity. Such research needs longer time horizons (see 1e).

1e. Extend the Time for Research Projects

For projects that are oriented toward researching new technologies (1d.), the schedule should be allowed to extend for more than 18 months and the technology review panel should be convened at intervals to assess progress. Other review panels are not needed.

1f. Systemic Service Innovation

The Hong Kong government should at least invest a certain portion of the public R&D expenditure in service innovation, particularly systemic service innovation, so that Hong Kong may reinforce its strengths in services and serve as a “testbed” for brand new service innovation. In this way, Hong Kong may be able to better serve its residents as well as China by leveraging indigenous innovation and local needs. When promoting systemic service innovations, the government needs to adopt a holistic and flexible approach, which will be different from the promotion of manufacturing-centric or technology-centric R&D.

1g. Evaluation and Potential Consolidation of the R&D Centres

The ITC should conduct intensive performance evaluations of the various R&D centres at the end of their five-year mandates. Based on this, the ITC may have to make a critical decision to consolidate the R&D Centres Programme. Consolidation makes even more sense when one takes into account the mismatch between public R&D and private R&D, especially in terms of the strategic areas selected by the ITC for the R&D Centre Programme. Supporting six R&D centres may not be viable given the weakness of private industry in most of these sectors. Adopting a more ambitious policy for the ITC, such as the Finnish model of SHOKs, probably requires a concentration of Hong Kong’s S&T resources as well as an increase in the total amount of resources committed.

2. Stimulate VC Investment with Longer Time Horizons and Technology Focus

Stimulate more VC funds with a longer time horizon and greater focus on new technology commercialization. One way is to encourage long-term investors to become limited partners of VC funds.

2a. Government Funds for VC

The government should channel university endowment funds and other government funds to VCs since their longer time horizons are compatible. This should also attract more foreign funds and at the same time reinforce Hong Kong's position as a financial hub. One option is to invest a small amount of governmental reserves (say 0.05%) as a legitimizing gesture and thereby encourage the endowment funds (estimated to be over \$50B) to follow suit (say 0.5%).

2b. Lift Prudent Man Rule for Mandatory Provident Fund (MPF) and Other Retirement Funds

The implicit "prudent man" rule could be lifted for MPF and other retirement funds, allowing them to invest a portion of such funds in non-publicly traded investment funds. PE funds may be more suitable given the investment objectives of retirement funds. A mere 1-2% of these funds (total HK\$600B) would amount to over \$10B and bolster the outlook of many local VC/PE funds and at the same time keep investment talent in Hong Kong.

2c. Government-sponsored VC Investment

ARF was reviewed and many lessons were learnt after its closure five years ago. Israel's Inbal program was a failure but the lessons learned from it led to the hugely successful Yozma program. Politics aside, the government may learn from these experiences and sponsor investors to form new VC funds that focus on technology start-ups. Such a new program shall incorporate new features as informed by the Yozma program (for details, see Avnimelech & Teubal, 2004),

- employ technology experts to administer the funds;
- recruit established VCs to run the funds and be co-investors;
- give full autonomy to the VC companies on investment decisions; and
- provide strong incentive on the 'upside' for the funded companies (i.e., the possibility of purchasing government's share at about cost within a median period, but no downside "guarantee" of losses).

3. Improve the Skills of VCs

3a. Develop professional training and qualifications for investment advisors in the VC and PE industry, angel funds, and private companies

In the US, investment advisors appeared in mid-1980's to advise institutional investors about venture investments after the US "prudent-man" rule was lifted (Gompers & Lerner, 2000, p. 8-10). They pooled resources from their clients, monitored existing investments, and evaluated new funds. They helped stimulate the growth of the VC industry in the USA. Hong Kong can establish qualifications similar to CFA and CFP in order to facilitate the investments of endowment and pension funds.

3b. Diversify the backgrounds of the general partners of VC firms

Encourage the VC/PE firms to recruit special partners who are retired or cashed-out entrepreneurs to complement the jobs of general partners who tend to have an accounting or financial background. If advisors are more widely available, it should be stipulated that governmental and endowment funds may be invested only in firms with partners fitting this profile.

4. Stimulate Angel Investments

4a. Provide Guidelines and Templates for Angel Investors

Expand and professionalize angel investment by developing guidelines, case studies of successes and failures, and templates for documents such as term sheets. Commission HKVC/PEA and universities to develop related training courses and networking events.

4b. Adopt the Enterprise Investment Scheme (EIS) of the UK

EIS of the UK can provide several policy options for Hong Kong. The UK experience has been reviewed thoroughly and seems to work well (Mason, 2006).

The goals of EIS are to establish the status of “Accredited Investors” and to define “high net-worth” individuals,⁸ These concepts give credibility to angel investors and entrepreneurs, ensuring that only those credible are allowed to participate in risky investments. The established UK system should be implemented in Hong Kong, Individuals can be self-certified if they (1) make high earnings (about HK\$1.5 M) or own valuable net assets (about HK\$5M), and (2) possess sophisticated investing experience in private companies (such as being part of an angel network or having served as professionals for private companies, or having experience in managing investments in private companies).

- Some of the tax incentives EIS used to encourage angels to invest in private companies can be adopted even though Hong Kong has no capital gains tax. These include tax relief at the basic rate and income tax relief on losses. The relief rate can be defined after careful study. Investors can invest up to HK\$2M per annum and must hold on to the investments for at least two years. Perhaps higher tax breaks shall be given to accredited investors who risk their money to invest in new technology firms. Such breaks should apply not only to investments in Hong Kong, but also in Shenzhen which has another significant presence of technology and people. The cities are sister cities and in light of more integration initiated by the central government,⁹ more angel investments across the border shall benefit Hong Kong in the long run.

5. Establish Small Business Investment Companies-like Program

Establish a Small Business Investment Companies (SBIC)-like program to stimulate investments in small technology businesses and to help to fill the equity gap. The UK’s Enterprise Capital Funds was modelled on the experience of the American SBIC program and has been successful since 2002 (Mason, 2006). A similar program should be implemented in Hong Kong. In essence the government will solicit competitive bids from qualified individuals (or companies) for plans to invest in small

⁸ In the US, referring to Preston (2004, p.6), the amended Security Act of 1933, & section 501 (c) (3) of the Internal Revenue Code.

⁹ http://www.straitstimes.com/Breaking%2BNews/Asia/Story/STIStory_323859.html

private companies (with a range of HK\$1M to \$15M). The government will match up to twice the amount raised by the bidder to form a fund, but will take a smaller share of the profits and an equal share of the losses. The investment period must be for longer than 2 years.

6. Luring Back Returnees

6a. Funds for Hong Kong Technologists Living Abroad

One way to do so would be to tie in certain venture capital matching funds mentioned above in 2c to bringing back experienced expatriate technologists to set up firms in Hong Kong. The matching funds might have to be made at very attractive rates in order to lure expatriates home (i.e. the Hong Kong matching funds would have to demand less equity than the market rate) with benefits, such as the buyback option suggested in 2c.

6b. Set up an Expatriate-Hong Kong Bridging Institution

Another important route to bind expatriate Hong Kong technologists to Hong Kong's technology sector would be for the state to set up or financially support a Monte Jade-like organization in Silicon Valley. Monte Jade Science and Technology Association, a Taiwanese-American organization based in Silicon Valley, played an important role in encouraging Taiwanese-American entrepreneurship linked to Taiwan. Hong Kong must seek similar means to connect with its expatriate technology community in the US and use this vehicle to communicate about opportunities and the availability of government support, such as the VC funding program (2c and 6a). This initiative ought to spur expatriates to participate more readily in Hong Kong's technology-intensive sectors.

7. Expand Hong Kong's Pool of Human Capital through Immigration

Several different options from already existing programs can be taken to expand Hong Kong's pool of human capital.

7a. Continue to Expand the ASMTP for Immigrants from the Mainland

The idea that human capital considerations ought to shape immigration policy toward the mainland is relatively new. The historic focus of the Immigration Department toward the Mainland has been exclusion. This began to change in the late 1990s . In 2003, the SAR government consolidated small provisional programs which aimed to attract talent to a few select occupations and sectors, into the Admission Scheme for Mainland Talents and Professionals (ASMTP), which is not restricted by occupation or sector.

ASMTP is a demand-driven approach. A Hong Kong employer who wishes to hire a Mainlander under the scheme must demonstrate that the new hire's skills, knowledge, or experience are not readily available in the Hong Kong labour market. The compensation package must be commensurate with local norms. (The new program for non-local graduates of Hong Kong universities has a similar design.) The design is a good one for general human capital development, facilitating access to the large Mainland talent pool without depriving Hong Kong's residents of opportunities. However, it is possible that demand to immigrate is somewhat suppressed, as a result of the history of exclusion. A continued incremental expansion of the scheme seems sensible.

7b. Revise and Extend the QMAS "Point System" for Immigrants

The Hong Kong government added a modest supply-push component to skilled immigration policy in 2006, the Qualified Migrant Admission Scheme. Like comparable programs in Canada, Australia, and elsewhere, individual applicants earn "points" towards admission on the basis of attributes such as age, education, work

experience, and language. The initial response to this opportunity was far below the quota, in part due to the perception that only Nobel prize-winners and Olympic medallists could qualify. Another potential deterrent for applicants under QMAS is the discretionary nature of the decision. In “point” systems abroad, surpassing a set threshold earns admission. In Hong Kong, the Immigration Department and any expert advisors that the department chooses to engage decide each case individually. A more transparent selection system may enhance the attractiveness of the program.

7c. Expand Recruitment for GEP Applicants

The General Employment Policy (GEP) is a demand-driven immigration policy that applies to skilled immigrants from other countries. The structure of the program is similar to that of the ASMTP. Although admissions under this policy have generally grown over time, they declined in 2002 and 2003, suggesting that applications do indeed reflect demand. Some interviewees expressed concern that broad quality of life considerations, such as education for school-age children and environmental pollution, deterred potential immigrants. They suggested that the government should make a greater effort to promote Hong Kong opportunities in the world’s talent centres, rather than “sit and wait.” Such an effort may well be worthwhile. The major responsibility for it should be in Invest Hong Kong or another agency charged with outreach, rather than the Immigration Department, where it would be in tension with the Department’s central mission.

7d. Tailor One of the Above Immigration Schemes to Target Certain Sector-specific Skills

Hong Kong could tailor existing programs in order to recruit technologists needed for certain targeted sectors. Both demand- and supply-driven methods could be applied, but Hong Kong should actively promote the program and engage in recruitment activities outside of Hong Kong.

8. Managing Science and Technology Cooperation with Mainland China

8a. Central Directory of all S&T Cooperation between Hong Kong and the Pearl River Delta

There should be a central directory of all the S&T cooperation occurring between the two regions. In 2007, the Hong Kong and Shenzhen governments set up a website to promote the sharing of the equipment, labs and professors at technological institutes. This could be expanded to include the entire region and would serve as a clearing house for all projects, which might help identify potential areas of future cooperation and prevent redundancy.

8b. Principles of Providing Hong Kong's S&T Resource and Services to the Mainland

For provision of Hong Kong's resources or services to firms or governments in the Mainland to go forward, one of two conditions must apply. The first condition is that the provision be part of a truly complementary effort in which providing resources and services offers a very high chance of upgrading or growing desirable activities in a complementary activity in Hong Kong. The second condition is that some Mainland organization reciprocates with an equivalent amount of resources or services.

An example of when the first condition of boosting complimentary activities applies is potential cooperation between APAS, the automotive R&D centre, and Mainland Chinese automotive firms. Hong Kong is not going to develop its own auto assemblers and the relationship between APAS and the Mainland automotive firms could lead to opportunities for Hong Kong's automotive components firms so it fosters highly complimentary activities.

A counter example where neither the first nor the second condition applies is Hong Kong Science Park's (HKSTP) provision of integrated circuit (IC) design services for Mainland firms. Regional and municipal governments in the Mainland

are competing fiercely with each other and Hong Kong to develop IC design clusters. Hong Kong has a big advantage in HKSTP because the Park can offer many sophisticated software-based services that US export controls prevent from being imported into the Mainland. Being able to gain access to Hong Kong's much higher quality services evens the playing field between Hong Kong and its competitors in the Mainland. The Mainland regions cannot offer equivalent services in return and do not even offer each other the same subsidized services they offer their own local firms so no reciprocity can be expected. In this case, Hong Kong should place conditions on its cooperation, such as requiring Mainland firms to move design teams to Hong Kong in order to receive the sought-after services, so as to foster Hong Kong's own design cluster.

8c. Greater Participation of Hong Kong Labs in National S&T Programs

Thus far, Hong Kong has had very little interaction with and received virtually no resources from the central government's S&T projects. Even those labs in Hong Kong recognized as key state labs have not received central government funding. Hong Kong should request true participation in national S&T programs.

8d. Diversification

S&T connections with the Pearl River Delta are clearly the most important, but Hong Kong also has to strengthen ties with other centres of innovation. In fact, the more tightly linked to the rest of the world Hong Kong is, the more valuable it is to the PRD; the more closely tied to the PRD, the more attractive Hong Kong is to the rest of the world. The local universities, HKSTP and the research institutes need to strengthen cooperation with Taiwan, Southeast Asia, Japan, Korea, and India. The government should also hold a HKSAR-ASEAN Technology Summit (HKSAR-India etc), designed to provide an opportunity for R&D institutions, academia, industries and government of ASEAN countries and HKSAR to interface.

9. Reforming Support for Fundamental Research in Hong Kong's University

Current schemes for HKSAR government support for fundamental research in the region's universities have flaws. The UGC research grant program relies too heavily on a block grant system that may not always reward research excellence. The Research Grants Council (RGC) competitive grant program, the GRF, accounts for too small a share of overall HKSAR funding for university research, and its average grant award is quite small. Steps should be taken to shift a greater share of the HKSAR government's financial support for university research towards competitive, peer-reviewed allocation processes.

9a. Expand RGC's Competitive Research Grants Program

The RGC's competitive research grant programs should be expanded to account for a greater share of overall HKSAR public funding for university research, perhaps as much as 25%. The administration of these grant programs should ensure that proposals are subject to peer review by internationally recognized scholars not those employed by HK universities.

9b. Salaries from Competitive Grants

Serious consideration should be given to enabling HK university faculty to charge a portion of their salaries to competitively awarded research grants from the RGC, the UICP, or other sources.

10. Provide Public Assistance for IP Commercialization and Exploitation

Despite the growing presence of subsidiary operations of global MNCs, local SMEs remain an integral part of the economy of HKSAR. A large number of SMEs in HKSAR lack the resources to exploit the IP created by other SMEs as well as the IP created by universities and public research institutes. Even with the development of a stronger IP professional services industry, it is unlikely for many of these SMEs to be able to afford such expertise. As such, there is a role for the government to subsidize part of the IP transaction and exploitation costs for local SMEs and start-up entrepreneurs. Based on the experience of other economies such as the US, Taiwan, Korea and Singapore, this can be implemented in a number of ways. For instance the SBIR grant scheme of the US encourages high tech spin-offs, the ITRI-consortium licensing approach of Taiwan facilitates rapid industry-wide innovation diffusion, or the TIP scheme of Singapore promotes fast adoption of new technologies by local SMEs by subsidizing the adoption cost.

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