

Chief Executive's
Commission on Innovation and Technology

Second and Final Report

June 1999

CONTENTS

Executive Summary

Chapter

- 1 Introduction
- 2 Institutional Arrangement
- 3 Building up Human Capital
- 4 Fostering an Innovation and Technology Culture
- 5 Creating an Enabling Business Environment
- 6 Setting up of Innovation and Technology Fund and Applied Science and Technology Research Institute
- 7 Concluding Remarks

List of Abbreviations

Acknowledgements

Annex

- A Terms of Reference of the Commission
- B Membership of the Commission
- C Written Representations to the Commission
- D Outreach Activities of the Commission
- E Existing and Proposed Government Institutional Setup for Promoting Innovation and Technology
- F Non-government Public Institutions :
Division of Responsibility for Service Delivery
- G Brief Description of Teaching Company Scheme,
Joint-research Matching Grant Scheme and
Industrial Research Chair Scheme
- H Types of Research and Development Activities
and Examples of Midstream Activities
- I Staff of the Commission

EXECUTIVE SUMMARY

Introduction

At the request of the Government of the Hong Kong Special Administrative Region, the Chief Executive's Commission on Innovation and Technology has pursued its task in two phases. The Commission completed the first phase and submitted a First Report last September. This report covers the second and final phase of its work.

2. The past year has seen a change from skepticism to general acceptance in the public mood about the importance of innovation and technology to Hong Kong's competitiveness. The focus of debate has shifted from whether Hong Kong should pursue such a course to how it should be carried forward. The business sector has responded positively and swiftly to this new course of development.

3. Hong Kong should not devote effort to state-of-the-art technology incompatible with the patterns of its competitive advantage. Instead it should emphasise innovation in all economic sectors, in terms of introducing improved technology and methods, penetrating new market segments, and entering into activities of higher value.

4. Hong Kong has the capability to become an innovation and technology centre. Technology is advancing and changing so rapidly that Hong Kong is not really behind its regional competitors in many areas. More important, Hong Kong must leverage on its areas of strength and develop its own niches. Some visible results should be achievable within three to five years. With sustained and concerted efforts from the entire community, Hong Kong should be able to reap substantial benefits in a decade.

5. The Innovation and Technology Fund (ITF) and the Applied Science and Technology Research Institute (ASTRI) recommended in the First Report will play a pivotal role in developing Hong Kong into a knowledge-driven and technology-intensive economy.

Institutional Arrangement

6. Innovation and technology policy cuts across many traditional policy areas. It must be dealt with holistically and coherently. This requires good co-ordination and leadership. We recommend the establishment of a policy group headed by the Financial Secretary and comprising relevant bureau secretaries to set and co-ordinate policy. In addition, a standing advisory body reporting to the Chief Executive should be set up to succeed this Commission. The policy group and advisory body should be serviced by a common secretariat with support from full-time science advisers. A separate body of sector-specific committees should advise on disbursements from the ITF.

7. We recommend that the Hong Kong Science Park, Hong Kong Industrial Estates Corporation and the Hong Kong Industrial Technology Centre Corporation be merged. The division of responsibility among various public institutions involved in service delivery should be sharpened. In particular, R&D support should be provided mainly by the universities and ASTRI. The Hong Kong Productivity Council should focus more on technology diffusion and productivity enhancement as the technological capability of industry grows.

Building up Human Capital

8. We recommend that Hong Kong continue to invest heavily in education, paying special attention to creativity, communication skills and information technology. A culture of lifelong learning among the workforce should be vigorously promoted, and more should be done to inspire interest in science and technology among young people. To build up a deep pool of technology managers and entrepreneurs, the universities should offer more multi-disciplinary programmes blending business, science and engineering.

9. There is an immediate need to attract talents from other places to bolster Hong Kong's intellectual capital and energise the technology sector in particular. This will spur economic growth and the creation of many more jobs. We recommend the Government to step up its overseas liaison and promotion

efforts in major technology centres such as the Silicon Valley, targeting especially at Chinese talents and technology entrepreneurs. In addition, Hong Kong must maintain its appeal as an attractive place in which to live and work.

10. We recommend that the immigration restriction on Mainland talents be relaxed. The talents should take up jobs contributing to Hong Kong's transformation into a knowledge-driven and technology-intensive economy. These jobs should not be conventional managerial or professional posts which can be readily filled by the indigenous workforce. The talents should possess outstanding qualifications, expertise or special experience. Mainland students in local universities who have outstanding academic achievement should be permitted to work in Hong Kong after graduation. Mainland talents should be admitted quota-free and be allowed to bring along their immediate family members.

Fostering an Innovation and Technology Culture

11. We recommend that the Government expand its incubator programme through a distributed model. Furthermore, a \$500 million funding scheme should be introduced to assist small entrepreneurs undertaking commercial R&D work at the pre-market launch stage. The ITF should also earmark \$250 million for a matching grant scheme for private companies undertaking commercial R&D work in collaboration with local universities and for other funding schemes promoting university-industry partnership.

12. We recommend that the Government consider organising sector-specific events involving industry and academia to develop action agendas for individual industries or industry clusters. Hong Kong should attract multinational companies to use it as a regional hub for application or service support and development, and generally as a base for R&D catering for the Asian market.

Creating an Enabling Business Environment

13. Hong Kong must maintain its business-friendly environment and be

vigilant in promoting competition. We urge the banking sector to pay more attention to the financing needs of small firms and the technology sector particularly. We recommend the Government to explore the feasibility of setting up a co-investment scheme providing government venture capital on a matching basis with private funds. Hong Kong must continue to combat vigorously infringements of intellectual property rights.

Concluding Remarks

14. Over the last 15 months, we have mapped out a blueprint of the steps needed to mobilise the stakeholders and the community at large to develop Hong Kong into a knowledge-driven and technology-intensive economy. Two key factors for enabling success are –

- a holistic and coherent approach to taking forward our recommendations, backed by clear and sustained commitment at all levels of the Government; and
- the acceptance and active support of industry, academia and the community at large.

15. The submission of this Second and Final Report marks the completion of our task.

The Main Report

CHAPTER ONE

INTRODUCTION

(This Chapter recaps the achievements of the Commission in the first phase, elaborates the Commission's views on some fundamental issues and gives a brief account of how the Commission has proceeded with its work in the second phase.)

1.1 This Commission was appointed by the Chief Executive in March 1998 to advise him on the measures necessary to realise the vision of developing Hong Kong into an innovation centre for South China and the region¹. Our specific mission is to identify the steps that Hong Kong should take, and the institutional arrangements that should be put in place, to drive forward innovation and technology upgrading in Hong Kong, so as to add value to its commercial and industrial activities and to its economic hinterland.

1.2 We were requested by the Government to complete our work within eighteen months and to submit an interim report by September 1998. Accordingly, we decided to pursue our task in two phases. We completed the first phase and submitted a First Report last September. This Second and Final Report covers the second phase of our work.

1.3 In the ongoing debate about the future course of Hong Kong's economic development, a key issue is how Hong Kong could strengthen its economic base in order to enhance its global competitiveness and achieve sustainable growth into the next century. Underlying this soul searching are a number of challenges facing Hong Kong. There is strong competition from neighbouring economies for Hong Kong's regional role in trade, finance, transportation and communications. With respect to manufacturing, Hong Kong must strive to support and further develop high-value activities. Hong

¹ The terms of reference and membership of the Commission are at Annexes A and B respectively.

Kong is also facing stiff competition from low-cost economies. A fundamental challenge is how Hong Kong should position itself in the knowledge-based, global economy of the 21st century.

1.4 The vision of developing Hong Kong into an innovation and technology centre is a timely response to these challenges.

Momentum for Change

1.5 The past year has seen a gradual change, from skepticism to general acceptance, in the public mood about the importance of innovation and technology to the competitiveness and future prosperity of Hong Kong. The focus of debate has shifted from whether Hong Kong should pursue such a course to how it should be carried forward.

1.6 The business sector in particular has responded positively and swiftly to this new course of development for Hong Kong. In February this year, seven technology-based companies with international operations announced plans to expand operation in or renewed their commitment to Hong Kong. The Cyberport project announced in March drew an overwhelmingly enthusiastic response from both local and foreign companies in information services. Recent developments are even more encouraging. A number of local conglomerates have shown keen interests in exploiting opportunities in the technology sector. Traditional manufacturing and service industries are eager to explore ways to upgrade their products or processes through technology application.

1.7 We are pleased by this noticeable gathering of interest and action constituting a momentum for change within a short while. It testifies to Hong Kong's dynamism and resourcefulness. We urge the people of Hong Kong to work resiliently and in unison for the fulfilment of the vision.

The Commission's First Report

1.8 The First Report and this report address different issues and are complementary. For ease of reference by readers, we briefly recapitulate below what we achieved in the first phase.

1.9 We broadly reviewed most of the issues relevant to our task, and studied in depth the following issues –

- Hong Kong's technological infrastructure.
- Tapping technological resources on the Mainland of China (the Mainland).
- Collaboration between academia and industry.

1.10 To realise the vision of developing Hong Kong into an innovation and technology centre, we recommended that Hong Kong adopt a dual approach, namely, by –

- fostering knowledge-driven and technology-intensive economic activities; and
- upgrading traditional industries (both manufacturing and service) through innovation and technology application.

1.11 We further recommended the following five-point strategy to advance the above approach –

- Strengthen technological infrastructure and promote technology entrepreneurship.
- Build up human capital meeting the needs of a fast-changing, knowledge-based economy.
- Enhance technological collaboration with the Mainland.
- Foster university-industry partnership.

- Lower information, financing and regulatory barriers.

1.12 We recommended that, as a first and important step, the Government signal to the community the Government's commitment to drive forward innovation and technology upgrading in Hong Kong. To underline this commitment and to provide a secure source of funding for implementing the strategy in paragraph 1.11, we recommended the Government to set up an Innovation and Technology Fund (ITF) with an initial injection of \$5 billion to meet requirements in the short to medium term.

1.13 We concluded that Hong Kong's technological infrastructure was weak in the area of midstream research and development (R&D). To bridge this gap, we recommended the Government to set up an Applied Science and Technology Research Institute (ASTRI) as soon as possible.

1.14 We studied in depth issues pertaining to technological collaboration between Hong Kong and the Mainland as well as between local universities and industry. We recommended many concrete measures to enhance such collaboration.

1.15 Regarding other issues relevant to the Commission's charge, we took stock of their current situation and outlined the general direction for our work in the second phase.

Reaction to First Report

1.16 In his 1998 Policy Address to the Legislative Council, the Chief Executive accepted the major recommendations in the First Report, including the establishment of the ITF and ASTRI.

1.17 We are pleased that the community as a whole supports the general thrust of the First Report. We have noted carefully the comments, suggestions and criticisms made by different quarters of the community ². We welcome all

² A list of the written representations to the Commission in the second phase is at Annex C.

the views expressed and have taken them into account in our work. We have noted the presence of confusion and possible misconception about certain fundamental issues. We consider it necessary to repeat or clarify the more important issues below.

(a) *Developing Hong Kong into a 'high-technology' economy*

Many people, including some of the media and most of the skeptics, commonly refer to Hong Kong's new vision as developing a 'high-tech' economy, and to this Commission as the 'high-tech commission'. The term 'high-tech' does not reflect the full picture and is somewhat a misnomer. What we advocate is turning Hong Kong into a knowledge-based economy, with growth driven by high-value and technology-intensive economic activities. Hong Kong should not promote high-tech for the sake of high-tech. Nor should it devote effort to state-of-the-art technology incompatible with the patterns of Hong Kong's competitive advantage. Instead, the emphasis should be on stimulating dynamism in all economic sectors for innovation and upgrading, by introducing improved technology and methods, by penetrating new market segments, and by entering into activities of higher value.

(b) *Basic approach to realise the vision*

We have recommended a dual approach as set out in paragraph 1.10 above. In pursuing this approach, we emphasise that industry must make its own choices and investments, which could not be supplanted by the Government. The Government's role is chiefly that of a promoter, signalling to the community the importance of innovation and technology. It should also play the role of a facilitator and supporter, by making essential investments in the physical, human and technological infrastructure, by creating an enabling business environment, and by providing suitable policy encouragement and incentives.

(c) *Focus areas*

We have suggested that Hong Kong should strive to become a centre of innovation and technology, in addition to maintaining its role as a centre of

trade, finance, transportation and communications. We have further envisioned that Hong Kong could become –

- a leading city in the world for the application and development of information technology, especially in Internet, electronic commerce and software engineering;
- a world-class design centre – for fashion, apparel, consumer electronics, toys and games, watches, optical goods and other products or services;
- a regional centre for multimedia-based information and entertainment services;
- a world centre for the development of biotechnology with focus on health food and pharmaceuticals based on Chinese medicine;
- a leading supplier of high-value products and components in areas where Hong Kong already excels today;
- a regional centre for the supply of professional and technological talents and services; and
- the marketplace for technology transfers between the Mainland and the rest of the world.

We have also highlighted some broad technology areas relevant to Hong Kong, and the application and development of which will help add value to and increase the competitiveness of relevant industries. These areas fall under four broad categories as follows –

- areas which will help enhance Hong Kong's existing strengths, e.g. information and communications technology, electronics, advanced manufacturing technology, product design, packaging design and supply-chain management;
- areas where Hong Kong's position relative to the Mainland offers distinct competitive advantages, e.g. Chinese medicine, Chinese language-based software, and technology to increase agricultural productivity;
- areas where Hong Kong may exploit emerging or new technology to create synergy with existing industrial clusters, e.g. multimedia technology for information and entertainment industries, materials technology for textile and garment, plastics, metal and construction industries; and
- areas in which Hong Kong already has considerable expertise in applying high or new technology, or where it may develop technical competence to solve its problems, e.g. civil engineering, telecommunications, and environmental technology.

(d) *Manufacturing vs service sectors*

Although the term 'industry' is used traditionally to refer to manufacturing industry, in the First Report and also in this report this term covers both manufacturing and service. Our recommendations apply to both. With growing specialisation in the design, production, marketing, delivery and servicing of manufactured goods, many activities hitherto undertaken by the manufacturer have been out-sourced³ to specialised service firms. Furthermore, the weight of service-related components in the manufacturing value chain has been increasing. As a result, the line between manufacturing and service has become blurred. Although the share of manufacturing to Hong Kong's Gross Domestic Product has shrunk considerably, a substantial part of Hong Kong's service industry is manufacturing-related – or producer service – as Hong Kong emerges as

³ For example, maintenance of equipment formerly performed in-house may be contracted out to a maintenance service company. Design, marketing and delivery may also be out-sourced.

a control, support and co-ordinating centre for production operations in the region.

(e) *Technology application vs development*

As we have pointed out in the First Report, it is as important for firms to acquire technology from outside sources as developing technology in-house. However, firms may not always be able to obtain useful technology off the shelf to meet their need without adaptation or further development work. More important, technology critical to adding value or increasing competitiveness may often be unavailable for sale. Regardless of whether technology is to be acquired or developed, firms should invest in increasing their technological awareness and capability to facilitate interaction, improvement and innovation.

(f) *Does Hong Kong have the capability to realise the vision ?*

Some people doubt whether Hong Kong has the capability to become an innovation and technology centre. They believe that Hong Kong already lags too far behind its regional competitors and that Hong Kong does not have the culture or human resources to support such development. In the First Report, we have discussed comprehensively the strengths and weaknesses of Hong Kong. We do not accept the argument that Hong Kong cannot catch up with its competitors. Certainly it would be futile for Hong Kong to follow the footsteps of its competitors blindly in areas where Hong Kong has no comparative advantage. But technology is advancing and changing so rapidly that Hong Kong is not really behind in many areas, or can even compete from the same starting point. More important, Hong Kong must leverage on its areas of strength and develop its own niches. We urge the people of Hong Kong not to underestimate their strengths and capabilities, which are the envy of many economies.

We have recommended a range of measures to address the gaps and weaknesses that Hong Kong currently faces. We are confident that over time, given its dynamism and resourcefulness, Hong Kong can overcome them.

(g) *When will results be seen ?*

In the First Report, we have emphasised that developing Hong Kong into an innovation and technology centre will be a relatively long-term process. Many of our recommendations are aimed at nurturing the fundamentals for a knowledge-driven and technology-intensive economy, such as strengthening technological infrastructure, promoting technology entrepreneurship and building up intellectual capital. They are not an antidote for Hong Kong's immediate difficulties. Given the current momentum, we are optimistic that some visible results should be achievable quickly and certainly within three to five years. With sustained and concerted efforts from the entire community, Hong Kong should be able to reap substantial benefits in a decade.

The Second Phase

1.18 In view of the strategic importance of the ITF and ASTRI to the promotion of innovation and technology upgrading in Hong Kong, we took a close interest in the Government's planning for their establishment. We gave our views and suggestions along the process. Apart from this, we studied in depth the following issues –

- Institutional arrangement.
- Building up human capital.
- Fostering an innovation and technology culture.
- Creating an enabling business environment.

1.19 Between the months of October 1998 and June 1999, the

Commission held seven meetings. In addition, Commission members met informally on many occasions to discuss various issues. To sustain the wide interest in the community generated since the publication of the First Report, and to solicit views from stakeholders on issues under consideration by the Commission, we organised five workshops in the second phase. Information about these activities is at Annex D.

1.20 The chapters that follow set out the outcome of our deliberation in the second phase of our work.

CHAPTER TWO

INSTITUTIONAL ARRANGEMENT

(This Chapter discusses the institutional arrangement for promoting innovation and technology upgrading in Hong Kong.)

2.1 We have conducted an overall, strategic review of Hong Kong's institutional setup for promoting innovation and technology upgrading. Our goal is to identify the best arrangement for advancing Hong Kong's initiative to develop into a knowledge-driven and technology-intensive economy.

2.2 We recommend the Government to establish a high-level policy group headed by the Financial Secretary to set and co-ordinate policy. We also recommend the establishment of a standing advisory body reporting to the Chief Executive to succeed this Commission. We recommend that the Hong Kong Science Park, Hong Kong Industrial Estates Corporation and the Hong Kong Industrial Technology Centre Corporation be merged. We also suggest sharpening the division of responsibility among non-Government public institutions involved in service delivery, as outlined below in this chapter.

General Consideration

2.3 In formulating our recommendations, we have taken careful note of the many representations to us. Some have underscored the importance of leadership and sustaining the momentum of change. Some others have emphasised the need for rationalisation and co-ordination. A few have called for revolutionary changes to the existing arrangement. In our view, the overriding concern should be to ensure that the new arrangement will work and best suit Hong Kong's circumstances. Any new setup must be empowered to do all that is required to meet its objectives. Above all, there must be strong leadership and commitment from the highest level in the Government. We

stress that any institutional arrangement should not be static; rather it should evolve and be perfected over time in the light of changing circumstances.

2.4 Broadly speaking, there are two levels of institutional arrangement for examination –

- Government institutions, which are mainly responsible for policy formulation, co-ordination and implementation.
- Non-government public institutions, which are mainly responsible for service delivery.

Government Institutions

Formulation and Co-ordination of Policy

2.5 Within the Government, the main policy bureaus dealing with innovation and technology policy are Trade and Industry Bureau, Education and Manpower Bureau, and Information Technology and Broadcasting Bureau. Some other bureaus may be involved in specific issues, e.g. Security Bureau on immigration policy. The main executive agency responsible for policy implementation is Industry Department (Ind D). Several other departments or agencies are also involved in specific aspects.

2.6 Innovation and technology policy cuts across many traditional policy areas - education and training, immigration, R&D, business and industrial applications, financial services and so on. The Government must deal with various aspects of innovation and technology policy holistically and coherently. This requires good co-ordination in policy development and implementation. It also requires determined leadership and commitment from the highest level. The current setup within the Government needs strengthening to meet these requirements.

2.7 There is a suggestion for the Government to establish a new bureau to take charge of innovation and technology policy. In our view, this is not the most effective way to tackle the matter given the wide-ranging and cross-cutting nature of the issues involved. We recommend the establishment of a high-level policy group headed by the Financial Secretary and comprising relevant bureau secretaries⁴, to set and co-ordinate major policy particularly on matters requiring action by more than one bureau, and to decide on overall resource allocation. Under the leadership of the Financial Secretary, the proposed setup will have sufficient clout and authority to champion the cause, iron out differences among bureaus and ensure well co-ordinated action.

Advisory Structure

2.8 At present, the Industry and Technology Development Council (ITDC) advises the Government on matters related to the strategic development of Hong Kong's manufacturing industry and the application and development of technology. The ITDC also advises the Government, through its seven subcommittees, on disbursements from the Industrial Support Fund (ISF). The ITDC has a sizeable membership including representatives from manufacturing industry associations and is serviced by Ind D. While the ITDC has tendered good advice on various subjects over the years, we consider that having an advisory structure with a sharper focus and line of reporting would be more effective, as the experience of this Commission shows.

2.9 Accordingly, we recommend the Government to set up a high-level standing advisory body reporting to the Chief Executive to succeed the Commission. This new body will advise on policy matters related to innovation and technology, and review relevant government programmes and services including the ITF and ASTRI. It may advise on specific issues at the request of the Government or initiate its own study of relevant subjects. The advice will be communicated to the Chief Executive direct.

⁴ The core members will be Secretary for Trade and Industry, Secretary for Information Technology and Broadcasting, Secretary for Education and Manpower, and Secretary for the Treasury. Other bureau secretaries, such as those responsible for immigration, environmental protection, medical and health matters, may take part as the need arises.

2.10 The new body should be compact in size, comprising members mainly from the business and academic sectors appointed on a personal basis. The chairman should be a non-official of high standing and have personal access to the top leadership of the Government. We recommend that the policy group proposed in paragraph 2.7 and the advisory body be serviced by a common secretariat to facilitate close interaction between them.

2.11 We recommend that the ITDC should be dissolved after the establishment of the new body, which will also take over the ITDC's advisory role on general industrial development matters (e.g. in relation to land supply and environmental protection).

Disbursement from Innovation and Technology Fund

2.12 We recommend that a separate body of sector-specific committees, to be serviced by Ind D, be set up to advise the Government on disbursements from the ITF⁵. Such an arrangement will enable the advisory body proposed in paragraph 2.9 to focus on policy matters, relieving it from the burden of going through details of project proposals⁶. The new setup will also ensure sufficient expertise to examine the many different types of projects. Being an executive department, Ind D will be best suited to support the assessment of project proposals, monitor approved projects and evaluate completed ones.

Technological Capabilities within Government

2.13 A number of submissions to us have made the point that the technological capabilities within the Government should be strengthened. Some have suggested that specialists from the business and academic sectors be appointed to serve in executive positions on contract or on a temporary loan basis. We share this view and recommend that the Government appoint some (say, two or three) full-time advisers with a strong science and technology background and preferably with industrial experience, to support the proposed

⁵ These sector-specific committees will also advise the Government on matters related to their respective sectors.

⁶ In 1998, Ind D processed more than 400 projects applying for funds from the ISF or SSF. With the introduction of various new programmes to be funded from the ITF, the number of applications is likely to increase substantially.

policy group and advisory body in policy making and strategy development, as well as providing specialist input to disbursements from the ITF. In addition, the Government should enhance civil servants' understanding of science and technology issues through training.

2.14 Charts showing the existing and proposed institutional setup are at Annex E.

Non-government Public Institutions

2.15 Non-government public institutions are mainly responsible for service delivery. These institutions provide five broad types of service as set out in the table below –

Service	Delivery agent
(a) Physical infrastructure	HKIEC, HKSP, HKITCC, Cyberport
(b) Incubation (nurturing technology-based start-up firms)	HKITCC, HKIB, some universities
(c) R&D support	ASTRI, universities, HKIB, HKPC
(d) Technology diffusion and productivity enhancement	HKPC, universities, ASTRI, HKIB, HKITCC, HKTDC
(e) Building up human capital	Universities, VTC, HKPC, ASTRI ⁷

⁷ ASTRI will provide post-university industrial research training to university graduates who aspire to become research engineers.

Legend

ASTRI	Applied Science and Technology Research Institute
HKIB	Hong Kong Institute of Biotechnology
HKIEC	Hong Kong Industrial Estates Corporation
HKITCC	Hong Kong Industrial Technology Centre Corporation
HKPC	Hong Kong Productivity Council
HKSP	Hong Kong Science Park
HKTDC	Hong Kong Trade Development Council
VTC	Vocational Training Council

2.16 We have reviewed the role and functions of the non-government public institutions in the context of these five broad categories of service. Our objectives are –

- to rationalise and streamline the support infrastructure;
- to delineate responsibilities clearly; and
- to promote co-operation and avoid fragmentation and undue duplication.

We have not conducted a thorough review of the organisational structure, management or day-to-day operation of individual institutions. Such a review would not be possible in the time frame within which the Commission has had to work, and would deserve the efforts of a much larger and dedicated team.

(A) *Physical Infrastructure*

2.17 The HKSP, HKIEC, HKITCC⁸ and the Cyberport deliver services that are basically land or accommodation-based. We recommend that the three existing Government-owned institutions – HKSP, HKIEC, and HKITCC – be merged. This will streamline the service delivery structure, create synergy and achieve better economy. More important, it will ensure

⁸ The HKITCC headquarters building provides purpose-built accommodation to technology-based companies in addition to its basic mission of operating an incubation programme.

consistency and complementarity in approach in terms of marketing effort, client targeting, referrals and so on. Although the Cyberport is a private-sector led project, proper co-ordination between the proposed merged body and the Cyberport will be essential for the same reason. We recommend that a suitable co-ordination mechanism be set up for the purpose.

(B) Incubation

2.18 We suggest that the incubation service should be expanded and shall discuss more about this in Chapter Four. We recommend that the merged body proposed in paragraph 2.17 take charge of the incubation programme.

(C) Research and Development Support

2.19 We suggest that the role and functions of the institutions involved in this area should be clearly defined, although a small degree of overlap and competition can be acceptable, as it should be good for gauging performance and boosting efficiency. Generally speaking, the main service providers should be the ASTRI and universities. As for R&D in biotechnology, there appears a good case for a closer relationship between the ASTRI and HKIB to be forged. The HKPC may continue to provide downstream support (e.g. product and process development, prototyping). As the technological capability of industry grows, the HKPC should concentrate more on its technology diffusion and productivity enhancement functions (see section (D)).

(D) Technology Diffusion and Productivity Enhancement

2.20 Similarly, we suggest that the role and functions of different institutions in the delivery of these services should be delineated as below to encourage collaboration and avoid undue duplication. Broadly speaking,

- regarding technology transfer, the ASTRI and universities should primarily focus on the transfer of generic or pre-competitive technology to industry, while the HKPC and HKIB should concentrate on downstream technology sourcing, acquisition and adaptation. The HKSP (and the proposed merged body) should actively provide referral services;

- regarding technical advice and support and productivity enhancement, the HKPC and HKIB should be the main service delivery agents. The universities, depending on the nature of the service required, could play a role as well. The HKPC and HKIB should seek the assistance of the universities and ASTRI in tackling problems requiring more intensive R&D input; and
- regarding technology fairs, networking and business matching, the HKPC and HKTDC should be the main service delivery agents, ideally working in collaboration. The HKSP (and the proposed merged body) should actively play a supporting and referral role.

(E) Building up Human Capital

2.21 The roles of the universities and VTC in academic and technical education are quite well defined. So is the ASTRI's role in post-university industrial research training. With regard to continued education and employee training, the universities, VTC and HKPC organise a variety of courses catering to different needs. It may be worthwhile for the Government and the new advisory body to undertake a more detailed examination in this area with a view to identifying possible gaps or duplication.

2.22 A chart showing the division of responsibility among the institutions for delivery of the five categories of service is at Annex F.

Interface among Institutions

2.23 The ASTRI and universities must foster close collaboration, in terms of joint R&D, cross-secondment of research personnel, sharing of equipment and facilities, internship and placement of graduates. We suggest that the Government put in place a suitable mechanism to facilitate this.

2.24 In theory, the role and functions of the ASTRI and HKPC are quite well defined. In practice, however, in the areas of R&D support and technology transfer, the division of work between the two may not be clear. For some projects, there will be a need for close collaboration between the two

bodies. A possible way to foster collaboration and avoid undue duplication is to allow for some overlap in membership of their management boards, and close dialogue between the two bodies in developing their respective programme plans.

Institute for Chinese Medicine

2.25 In his 1998 Policy Address, the Chief Executive announced that the Government would examine the case for establishing an Institute for Chinese Medicine. In principle, we support the establishment of an institute to provide the focal point for efforts on R&D, standardisation and quality assurance in Hong Kong's bid to become an international centre for Chinese medicine. The proposed Institute is being pursued actively by the Government, but its precise role and functions are still being considered. Thus, we have not covered the Institute in our discussion of institutional arrangement. The Government should ensure that the Institute, if established, will be consistent with the overall institutional arrangement.

Resource Implications

2.26 Any good institutional arrangement could only work if it is managed, resourced and staffed adequately. Before appointing members to advisory committees and management boards of public bodies, the Government should ascertain that the appointee would have the time and be prepared to contribute to the work of the committee or board. The Government bureaus and departments concerned must have sufficient financial and staffing resources for implementing the recommendations in our two reports.

CHAPTER THREE

BUILDING UP HUMAN CAPITAL

(This Chapter discusses issues related to education and training, and recommends measures to attract talents from other places.)

3.1 Human capital is the single most important factor supporting Hong Kong's development into a knowledge-driven and technology-intensive economy. We recommend that Hong Kong continue to invest heavily in education and training. The community should do more to inspire interest in science and technology among young people. Apart from this, Hong Kong must attract talents from other places to build up its intellectual capital. In particular, we recommend that the immigration restriction on entry of Mainland talents be relaxed. We set out details of our deliberation below.

Education and Training

3.2 Education is fundamental to cultivating the abilities of people. Apart from nurturing a creative mind, education equips people with knowledge and skills, particularly in using information and technology, both of which are key elements in creating wealth and employment in the knowledge-based economy.

3.3 Education-related issues are wide-ranging and complex, deserving dedicated study on their own by experts in the field. As mentioned in the First Report, we have not attempted to examine educational issues in detail. We note that the Government has been according top priority to improving education, and a comprehensive review of the education system is under way. We repeat our strong conviction that Hong Kong should continue to invest heavily in education, paying special attention to creativity, communication skills and information technology.

3.4 Education reform will take a generation to lift the overall quality of Hong Kong's human capital. It is important that those already in work also improve their skills. This is necessary especially in the fast-changing, knowledge-based economy where new skill requirements emerge rapidly. We suggest that the Government should vigorously promote a culture of lifelong learning among the workforce in collaboration with industry. The Government already offers generous tax incentives for such purpose. The existing New Technology Training Scheme provides financial support for companies to send their employees to acquire new technology. The Government should continue

to publicise and improve the scheme and provide adequate resources to meet demand.

Building up Technological Manpower Pool

3.5 In the First Report, we have pointed out that there are shortages of quality research scientists and engineers in industry and of skills in the management and transfer of technology. We have also noted the scarcity of technology entrepreneurs.

3.6 At present, our universities offer some 3 600 research postgraduate places, constituting about 5% of the total tertiary student numbers. However, about one-third of these places are taken up by non-local students because there are insufficient local graduates qualified and willing to pursue postgraduate research studies. More students must be attracted to take up courses in science and technology fields. The goal is to increase the number of our science and engineering students, including some of the best, pursuing graduate research studies with a view to a career in R&D. We are pleased to note that, owing to wide publicity about innovation and technology beginning last year, as well as the Government's strong commitment to this new course of development for Hong Kong, the number of university applicants to the science and engineering streams this year has increased overall by 20%. We urge the Government and relevant non-government institutions to do more to inspire interest in science and technology among young people.

3.7 Hong Kong must build up a deep pool of technology managers and entrepreneurs. We suggest that the universities offer more multi-disciplinary programmes blending business, science and engineering at both undergraduate and postgraduate levels. The importance of mixing students from different disciplines is corroborated by research studies⁹. We also suggest that continuing education programmes with emphasis on technology management and entrepreneurship should be offered or expanded.

⁹ The Massachusetts Institute of Technology has found that, among technology start-up companies established by its graduates, 80% of those which have both business and engineering graduates have succeeded, whereas 80% of those made up of either business or engineering

Attracting Talents to Hong Kong

3.8 In the knowledge-based economy, intellectual capital is a factor of production as important as, if not more important than, financial capital. Bringing in additional intellectual capital would boost economic growth and employment in the same way as external financial capital contributes to the economy. This is supported by Hong Kong's own experience as well as those of many successful economies in the world.

3.9 As we have pointed out in the First Report, in its post-war economic development Hong Kong has benefited significantly from a large pool of entrepreneurs and skilled and motivated workers from the Mainland. In addition, Hong Kong has a sizeable expatriate business community which brings to Hong Kong new ideas, technical know-how and advanced management practices from all over the world. These are important contributing factors to the development of Hong Kong into the international business centre that it is today. Likewise, the Silicon Valley benefits from bright and talented people from all over the United States and the rest of the world. Israel owes its phenomenal techno-economic development in the last decade to some 750 000 immigrants from the former Soviet Union, many of them highly skilled. A liberal immigration policy to attract talents is a common thread among many successful economies in the world.

3.10 To jump-start the development of higher value and more technology-intensive economic activities, Hong Kong must attract talents from other places to augment its intellectual capital quickly. By talent, we mean high-calibre knowledge workers such as research scientists and engineers, experts with knowledge-intensive skills, young graduates with top-class brainpower, technology entrepreneurs and so on. A major potential asset of Hong Kong is the rich pool of Chinese talents living on the Mainland or studying or working overseas. Hong Kong should take a combination of immigration and other measures to tap this potential.

Chinese Talents Living Overseas

graduates only have failed.

3.11 The overseas Chinese community is a very valuable source of talents for Hong Kong, as the experience of Taiwan suggests¹⁰. For talents living outside the Mainland, regardless of their origin, Hong Kong has a liberal policy for their entry for employment¹¹. The main issue is creating an environment in Hong Kong that offers attractive opportunities and living conditions to these people. This will require concerted efforts from both the public and private sectors. The expansion of tertiary education in the 1990s has attracted many overseas scientists and researchers to local universities. The ASTRI, when established, will serve as another focal point for attracting these people. However, it will fall mainly upon the private sector to create the employment and business opportunities for them. The various measures recommended in the First Report and in this report to help foster a cultural change in the business sector should be useful in this regard.

3.12 We recommend that the Government step up its overseas liaison and promotion efforts in major technology centres such as the Silicon Valley, targeting at talents and technology entrepreneurs. Such efforts may include, for example, periodic 'recruitment' missions headed by senior officials in the Government. The purpose is to underline the Government's commitment to the cause, disseminate information about opportunities available in Hong Kong, encourage talents to come here, and provide assistance to them where necessary and appropriate.

3.13 In addition, Hong Kong must strive to maintain its appeal as an attractive place in which to live and work. This involves, among other things, reducing environmental pollution, ensuring adequate school places catering for children of expatriates, and enriching Hong Kong's cultural life. We recognise that Hong Kong's high cost of accommodation is a negative factor in attracting talents. The downward adjustment in housing prices since the Asian financial turmoil should help to ease this problem. There has been a suggestion that the Government should subsidise the accommodation of overseas talents. This is a highly controversial and divisive issue, as there is also a competing demand for

¹⁰ Overseas Chinese talents play an important role in the development of Taiwan's industrial science and technology. For example, 40% of the enterprises in the Hsin-Chu Science-based Industrial Park are founded by overseas Chinese talents. Between 1991 and 1997, Taiwan attracted some 11 000 overseas Chinese technological talents.

¹¹ Where Mainland talents are concerned, those living overseas for more than two years may apply for employment in Hong Kong under similar criteria as other overseas talents.

affordable housing from the public at large, as well as from other members of the expatriate business community in Hong Kong. We do not recommend such a measure.

3.14 Although the foregoing paragraphs focus on Chinese talents, one should not lose sight of non-ethnic Chinese talents who will equally benefit Hong Kong. The issues set out above are also relevant to them.

Admission of Mainland Talents

3.15 Unlike their overseas counterparts, talents living on the Mainland are generally barred from entry into Hong Kong for employment because of immigration policy reasons. In 1994, the Government launched a one-off pilot scheme to allow up to 1 000 Mainland professionals to work in Hong Kong. Under this scheme, companies might apply for a quota place to recruit from the Mainland. Candidate employees must be graduates of one of 36 key Mainland tertiary institutions and have relevant working experience. The professionals admitted would not be allowed to bring along their family to Hong Kong. Although applications for quota places numbered more than 3 000 and allocations had to be determined by balloting, only about 600 places were eventually taken up. The low utilisation rate was partly due to difficulties encountered by employers in finding suitable candidates, and partly due to the long time needed for quota allocation, recruitment and entry approval which brought uncertainty to employers.

3.16 If the Silicon Valley (or New York or London) had limited its talent pool to people within its geographical boundary, instead of absorbing the best talents from outside, it would not have achieved the economic success it enjoys today. The current immigration restriction on Mainland talents detrimentally affects building up intellectual capital in Hong Kong and its future economic development. We recommend that the restriction be relaxed as soon as possible, so as to admit some of the brightest and very best people from the Mainland. Such a move would significantly bolster Hong Kong's talent pool and energise the technology sector in particular, spurring economic growth and the creation of many more jobs. Developing Hong Kong into an innovation and technology centre would in turn bring substantial benefits to the Pearl River Delta economy and the Mainland as a whole.

3.17 We recommend that, as a general criterion, the talents admitted should take up jobs in areas contributing to Hong Kong's transformation into a knowledge-driven and technology-intensive economy. These jobs should not be conventional managerial or professional posts which can be readily filled by the indigenous workforce. As for technological talents, their expertise may be in one of the four broad categories of technology areas set out in paragraph 1.17(c) of this report. These should be supplemented by non-technological areas, including the financial field and other knowledge-intensive sectors which have good growth potential – such as business support services, design and fashion, and content development for information or entertainment services. We consider it inappropriate to specify a definitive list of economic sectors where Mainland talents will be required and may be admitted. Any such restriction would be highly inflexible.

3.18 Consistent with the objective of attracting the brightest and the best from the Mainland, the talents to be admitted should possess outstanding qualifications, expertise or special experience. To allow for greater transparency and prevent abuse, we recommend that candidates should meet either one of the following criteria –

- (a) they must possess a degree, normally a PhD, from a reputable Mainland or overseas tertiary institution, and have relevant working / R&D experience which demonstrates their outstanding ability. The PhD requirement may be waived if candidates can supply other evidence of their outstanding ability, e.g. recognised R&D achievement, high-level technological accreditation, expert practical experience, etc.; or
- (b) they must be recent graduates or postgraduates with outstanding academic achievement from top-notch Mainland or overseas universities.

3.19 A sizeable number of Mainland undergraduate or postgraduate students are undertaking full-time study in local universities. Under the current policy, all of them must leave Hong Kong after completing their study here. This is a significant loss to Hong Kong. We learn that quite a number of such students after graduation have found gainful employment in the United States, Singapore or other developed economies. We recommend that Mainland students undertaking full-time study in local universities be treated the same as those under paragraph 3.18(b).

3.20 We recommend that no quota be set on the talents to be admitted. First, with the type of high-calibre talents being targeted, the economy and the employment market would benefit from as many talents as the market demands. Second, it would be practically impossible to assess the number of talents required as any manpower survey done is unlikely to be accurate. Finally, introducing a quota would create considerable bureaucracy and inflexibility, causing delay and uncertainty on the part of the companies recruiting talents, as the experience of the 1994 pilot scheme has shown.

3.21 To ensure that the talents admitted can contribute to Hong Kong's economic development and will not become a burden of Hong Kong, candidates should have secured employment relevant to their qualification or outstanding ability before their entry is approved. In addition, employers should have demonstrated technological and financial capabilities to undertake the project for which the talent is employed. However, the talents should be allowed to change jobs, subject to the approval of relevant authorities, after working in Hong Kong for a while, say, one year. This will ensure that the talents will not be exploited or become 'cheap labour', undercutting local wage or employment.

3.22 To increase the attraction of Hong Kong for the brightest and the best Mainland talents, we recommend that they be permitted to bring along their immediate family members to Hong Kong.

3.23 Having regard to the experience of the 1994 scheme, the Government should devise a mechanism for processing applications efficiently, say, the whole process to be completed within one month. This mechanism must also be able to prevent abuse effectively. We recommend that the Government provide adequate resources for it to ensure that these objectives are met.

Technological Collaboration with Mainland

3.24 Apart from recruiting talents to work in Hong Kong, industry should take good advantage of the huge pool of technological resources resident on the Mainland. These include R&D infrastructure and the talent pool. In the First Report, we have recommended measures to encourage industry to utilise these resources. We wish to highlight in particular the enormous potential of Shenzhen, which has made very rapid progress on the development of its high-technology sector in recent years. Given its nearness to Hong Kong, there is great scope for collaboration between the two places.

Short-Term Business Visit to Hong Kong

3.25 As technological exchanges and collaboration between Hong Kong and the Mainland, particularly the Pearl River Delta area intensify, there will be a growing need for frequent contact and interaction between technological personnel of the two places. For example, research engineers employed by Hong Kong businesses on the Mainland may need to travel to Hong Kong periodically to undertake special laboratory work or training. Scientists in Mainland academic or research institutions may need to conduct short-term research work with their partners in Hong Kong. In the First Report, we have pointed out the need for government action to ease cross-border travel of research scientists and engineers in the two places. We urge those concerned to give priority attention to this.

CHAPTER FOUR

FOSTERING AN INNOVATION AND TECHNOLOGY CULTURE

(This Chapter recommends measures to foster technology entrepreneurship, promote industry awareness about innovation and technology, facilitate capacity building and information dissemination, and attract multinational companies to Hong Kong.)

Fostering Technology Entrepreneurship

4.1 A key strength of Hong Kong is the rich entrepreneurial spirit of its people and business. Our goal is to channel this strength to develop the technology sector of Hong Kong and nurture knowledge-driven and high-value economic activities. We examine below four programmes to foster technology entrepreneurship in Hong Kong. In particular, we recommend that the Government expand its incubator programme through a distributed model. We also recommend the introduction of a funding scheme to assist small entrepreneurs undertaking commercial R&D work.

(A) *Technology Incubator*

4.2 A technology incubator provides low-cost, accommodation-based facilities and shared services to nurture new technology-based firms. Generally speaking, a technology incubator provides four types of service as follows –

- Physical Infrastructure
This may include shared office space and laboratory and testing facilities.
- Management Support
Start-up firms usually lack business know-how to develop and commercialise their innovative ideas or technology. The incubator

programme can help the firm in developing a business plan, in technology assessment and market studies, in marketing, as well as in legal matters including intellectual property protection and licence agreements.

- Access to Finance

The incubator programme can help start-up firms to solicit equity capital from venture capital funds or business angels¹².

- Networking

The incubator programme can help firms to link up with other service providers, such as universities and other technical support bodies, and with potential business partners.

4.3 We recommend that the Government expand its incubator programme¹³ through a distributed model, i.e. physical facilities are dispersed to, for example, the universities, Science Park, and other relevant publicly-funded support bodies. Given Hong Kong's compact environment, it is not necessary to house all the start-up firms under one roof to facilitate interaction or service provision. Instead, linking the incubator programme more closely to universities, research institutions or technology parks would facilitate access to technical facilities, libraries and databases, as well as cross-fertilisation of ideas.

4.4 However, we recommend that the various support services, such as management support and networking, be centralised as far as possible to achieve economy of scale.

(B) Applied Research Fund Scheme

4.5 Through the \$750 million Applied Research Fund (ARF) scheme, the Government supplies equity capital to promising technological ventures undertaken by local firms, either on their own or with non-local partners, say, a Mainland research institution. The management of the ARF scheme is contracted out to three private venture capital firms, which are close to the

¹² See paragraph 5.12 for a discussion of business angels.

¹³ The incubator programme is operated by the HKITCC. Paragraph 6.10 of the First Report describes its features. Paragraphs 2.17 - 2.18 of this report recommend a new institutional

market and which can provide useful input to the business development of the venture. This move has initially proved a success. In the six months since the contracting out in November 1998, the three firms received 166 written proposals and already made six investments totalling \$95 million. We consider the ARF a good scheme that should continue and be improved and expanded where appropriate ¹⁴.

(C) Financial Assistance for Companies at Seed Stage

4.6 The experience of many economies shows that there is a funding gap at the seed stage ¹⁵ of a firm where an inventor or entrepreneur needs a relatively small amount of capital to develop or prove an innovative concept and to produce a prototype, before the final product or service is brought to the market. This is the stage where the venture capital industry as a whole, especially in economies outside the United States, has a low level of investment. However, without a healthy supply of such entrepreneurial activities, the vitality of venture capital investment at later stages of the growth of a firm is reduced. There is a case for the Government to play a pump-priming role by providing financial assistance to small firms undertaking such activities. To this end, we recommend the introduction of a Small Entrepreneur Research Assistance Programme (SERAP), which is to some extent modelled after the Small Business Innovation Research Program of the United States and the financial assistance scheme under Israel's technology incubator programme.

4.7 Under this proposed programme, a small firm (with, say, less than 30 employees) which is registered and based in Hong Kong may receive financial assistance of up to \$2 million for undertaking a commercial R&D project at the pre-market launch stage. Twenty percent of the grant will be paid upfront for exploration of the feasibility of the project in the first six months. Projects that successfully pass this feasibility test will get the remainder of the funding. The second phase of the project must be completed within the next 18 months. In principle, the applicant will be required to make a matching contribution (on, say, a one-to-one basis) in cash or in kind.

arrangement for running the incubator programme.

¹⁴ See paragraph 5.11 of this report for further discussion on this issue.

¹⁵ Paragraph 5.4 describes the different stages of development of a firm in terms of financing needs.

4.8 The financial assistance will be given on a project-by-project basis. To qualify for assistance, the applicant must demonstrate that –

- (a) the project has innovative technological content; and
- (b) the project has a reasonable chance of successful development of a new product, process or service that can be brought to the market.

In view of the high-risk nature of commercial R&D work, the selection of projects under criterion (b) should not be too conservative, lest it would defeat the purpose of the scheme.

4.9 We suggest that, say, \$500 million in the ITF be earmarked for the SERAP for an initial period of five years. This should be able to support 50 - 70 projects each year.

4.10 We suggest that if the product, process or service developed by a funded project eventually generates revenue, in principle the Government should seek to recoup the grant. This may take the form of a royalty of, say, up to 4% of the revenue received until the grant is fully repaid. If the applicant prefers or if there are investments or acquisitions by venture capitalists, the grant may be repaid in full in one lump sum. We recognise that the administrative costs involved in tracking a large number of projects and in collecting small payments spread over a long period of time could possibly be higher than the money recovered. In appropriate cases, it may be justified to terminate the collection of royalty from a cost-benefit standpoint. We suggest that the Government examine further the issue of recouping grants under the SERAP.

4.11 As with other ITF projects, it is essential to devise appropriate monitoring and evaluation measures for the SERAP. The success of the SERAP should not be measured by the direct return on investment of the scheme itself. From the public policy standpoint, a scheme of this kind which can breakeven should be regarded as a failure because the selection is likely to be much too conservative. The benefit of the SERAP lies in stimulating innovative ideas and technology entrepreneurship, which will generate indirect spin-offs and

wider economic benefits to Hong Kong in the longer term.

(D) Matching Grant for University-Industry Partnership

4.12 Based on a recommendation in the First Report, the Government will introduce a matching grant scheme for private companies undertaking commercial R&D work in collaboration with local universities. We suggest that, say, \$250 million in the ITF be earmarked for this and other matching grant schemes for encouraging university-industry partnership¹⁶. These schemes will encourage industry to devote more efforts to R&D and make greater use of the research resources in the universities.

Promotion and Publicity

4.13 In fostering an innovation and technology culture, a key role of the Government is 'signalling' – highlighting issues of importance to industry. The appointment of the Commission, the promulgation of a clear policy, and the substantial financial resources committed in the 1998 Policy Address to promoting innovation and technology upgrading have generated public awareness about the subject. It is important to seize on this momentum by sustained promotional efforts. These may include holding seminars, exhibitions and awards¹⁷, and may be organised by the public or private sector. We suggest that more of such activities be held, and government financial support be given where appropriate.

4.14 We recommend the Government to consider organising sector-specific events involving industry and academia to discuss major technology options and to develop action agendas for driving forward innovation and technology upgrading in individual industries or industry clusters. For example, the Government has developed 'Digital 21', an action agenda or strategy for promoting information technology in Hong Kong involving Government, industry and academia. Similar action agendas may be developed for, say, Chinese

¹⁶ See paragraph 6.4(b) of this report for additional information about these schemes.

¹⁷ Some examples are the Technology Week organised by Ind D in 1997 which comprised a series of workshops and seminars plus a technology exhibition involving academia and industry, the annual Hong Kong Awards for Industry and Hong Kong Services Award.

medicine, design, and other areas identified in paragraph 1.17(c) as having good potential for development.

Capability Building and Information Dissemination

4.15 We suggest that the Government's goal in this area should be two-fold –

- to facilitate the adoption and adaptation of technology by firms;
and
- to improve the innovative capacity of firms.

To this end, we suggest that the Government consider adopting the following measures –

- finance from the ITF projects undertaken by universities, industry or technology support bodies that seek to diffuse innovative ideas or technology to industry;
- strengthen technical assistance and information networks for, say, technology sourcing and acquisition, as well as helping firms to identify technology needs and problem solving;

- compile and disseminate good practices and success stories (e.g. successful projects funded by the ISF and the future ITF, successful cases of technology application) through publications and the media;
- explore the feasibility of establishing a system of comparative evaluation or benchmarking on innovation among firms, to enable them to compare with leaders in the field;
- conduct sector-wide technology foresight exercises periodically to provide medium to long-term forecasts of technology trends for reference by industry; and
- encourage co-operation among firms in addressing technology issues so as to pool resources and share risks. Possible measures include helping to establish sector or cluster-specific industry associations and supporting R&D projects sponsored by them.

4.16 Various technology support bodies will have a role to play in these areas. In particular, the HKPC will play a pivotal role. We reiterate the importance of avoiding duplication of efforts and encouraging collaboration among different players.

Attracting Multinational Corporations to Hong Kong

4.17 Among cities in East Asia, Hong Kong is used by the largest number of multinational companies as regional headquarters to control their operation in the region. However, most of them perceive Hong Kong as a business city rather than as a base for technology development or high-value production.

4.18 Hong Kong should strive to attract multinational companies to use it as a regional hub for application or service support and development, and generally as a base for R&D catering for the Asian market. These activities will benefit Hong Kong by creating high-value jobs, bringing in know-how,

technology and capital, and engendering the growth of indigenous supporting industries.

4.19 We are pleased to note that Hong Kong's initiative on innovation and technology has generated positive interests among many multinational corporations, particularly those seeking to exploit new opportunities in Asia in the wake of the financial turmoil. In February this year, we invited seven technology-based companies with international operations¹⁸ to a joint press conference at which they announced plans to expand their operation in or renewed their commitment to Hong Kong. We hope that this would encourage other multinational corporations sitting on the fence to follow suit.

4.20 In March this year, the Government announced the Cyberport project. This is a very significant step taken by the Government to create in Hong Kong a critical mass of high value, technology-intensive companies in the information services sector. We note that at least ten leading technology-based multinational corporations have announced their intention to operate in the Cyberport, and many more have registered their interest. The Science Park to be operational in 2001 will be another important piece of infrastructure for attracting multinational corporations. We urge the Government to expedite the development of these two projects.

4.21 The two crucial factors for attracting multinational corporations to Hong Kong are abundant supply of high-quality human capital and good physical and technological support infrastructure. A good living environment is also important. We suggest that the Government focus attention on these areas.

4.22 We have examined the need for introducing tax incentives to attract multinational corporations to Hong Kong. Hong Kong currently has a simple tax system with low rates by international standards. In addition, its tax system provides generous incentives to stimulate technology application and development. All recurrent expenses as well as machinery and equipment costs involved in R&D can be fully deducted in the tax year in which they are incurred. Expenses on R&D-related buildings are subject to accelerated depreciation (an additional 20% in the first year) for tax purposes. Apart from

¹⁸ These seven companies were 3M, H&Q Asia Pacific, Motorola, Nortel Networks, STAR TV, Sybase, and VTech.

R&D expenses, Hong Kong's tax system allows for full deduction of expenses related to technical training and immediate 100% write-off of machinery and equipment related to manufacturing as well as of computer hardware and software owned by end-users. All the deductions can be carried forward to any future tax year. These provisions as a whole compare favourably with those in most developed economies. We do not consider it necessary to recommend any additional tax incentives.

Strengthening Inward Investment Promotion

4.23 Hong Kong should promote its image overseas more aggressively, particularly its vision to become an innovation and technology centre and the various initiatives being implemented. There is a need to strengthen Hong Kong's inward investment promotion efforts. The Government has commissioned a consultant to study thoroughly the issues involved and we have not gone into specific details on this subject.

CHAPTER FIVE

CREATING AN ENABLING BUSINESS ENVIRONMENT

(This Chapter discusses issues relevant to creating an enabling business environment for innovation and technology upgrading.)

5.1 Hong Kong has a business-friendly environment with generally strong inter-firm competition and few administrative barriers. The Government must maintain this crucial edge of Hong Kong. We urge the banking sector to pay more attention to the financing needs of small firms and the technology sector in particular. We recommend the Government to explore the feasibility of setting up a co-investment scheme providing venture capital on a matching basis with private funds. Hong Kong must keep its intellectual property protection regime up-to-date with technological development, and be vigilant in combating infringements of intellectual property rights. Details of our deliberation are set out below.

Lowering Administrative Barriers

5.2 One of Hong Kong's major strengths is its business-friendly environment. The Government adopts a hands-off approach to business and strives to keep regulation to the minimum necessary. Since 1996, the Government has introduced a Helping Business Programme to identify and remove undue administrative barriers by cutting red tape, eliminating over-regulation, and reducing cost of compliance. We applaud these efforts.

Promoting Competition

5.3 The pressure of competition is a good stimulant for firms to

innovate or improve their technology. We note that Hong Kong's basic strategy to foster competition is to allow the free play of market forces and to promote free trade. With a level playing field for foreign and domestic firms, goods and services, domestic industry is exposed to the pressure of international competition. In recent years, Hong Kong has paid increasing attention to restrictive practices¹⁹ that limit market accessibility or contestability. We note that the Government is taking steps to tackle such practices on a sectoral basis. We support these efforts and urge the Government to be vigilant against anti-competitive practices.

Financing Innovative Commercial Activities

5.4 Access to finance is a crucial element for the commercialisation of innovative ideas or R&D results. In terms of financing needs, an entrepreneurial firm usually evolves through four stages of development –

- *Seed stage, where the initial concept of the business is being formed and working models of products being researched and developed. The financial needs are relatively small and entrepreneurs often have to meet the needs from personal resources.*
- **Start-up** stage, where the operation is formalised and the product or service produced. At this stage, the firm may have significant financial needs, e.g. to pay salaries, purchase operating equipment and for working capital, but has little track record or collateral available. Most new firms fail at this stage.

¹⁹ Such practices include, for example, price fixing, bid-rigging, market allocation, sales and production quota, joint boycotts, discriminatory standards, and abuse of dominant market position.

- Expansion stage, where having built up a track record, the firm seeks additional capital to expand production or marketing capacity.
- Sustained Growth stage, where profits and cash flows are sufficient to meet most of the firm's needs but the pursuit of new business opportunities require external finance.

5.5 Broadly speaking, the firm may meet its financing needs from two types of external finance : loan and equity.

Loan Financing

5.6 Traditional financial institutions such as banks are generally reluctant to provide longer term finance to firms in the early stages of their development. This is because such firms have no proven track record and are less likely to be able to provide collateral. Technology-based companies also tend to face greater difficulty in securing loans from banks which usually have difficulty in assessing the technology (which often is the major asset of the firm) and in distinguishing between good and bad loan proposals.

5.7 We note that the Government has introduced a Special Finance Scheme which provides a guarantee of up to 70% of the loan by a financial institution to firms. This scheme should partially ease the difficulty of small and medium-sized enterprises (SMEs) in obtaining loans. We urge the banking sector to pay more attention to the financing needs of SMEs and the technology sector in particular, insofar as it is consistent with prudent operating principles. There is a need for the banking sector to develop better capabilities in assessing risks for innovative or technology-based businesses. The Government should explore the feasibility of other innovative approaches in tackling the problem faced by such firms.

Equity Financing : Venture Capital

5.8 Venture capital is a type of equity finance managed by firms of full-time professionals who invest in companies that are not publicly listed. Besides funding, venture capital investments may provide added value to the

investee company through advice on strategic planning and business management. Venture capital firms aim at returns in the form of capital gain rather than dividend. They may invest money on the basis of an entrepreneur's promising idea, a form of 'collateral' not accepted by traditional financial institutions.

5.9 Hong Kong has a vibrant venture capital industry, which is the largest in Asia in terms of capital under management, with a total venture capital pool of US\$11.6 billion in June 1998²⁰. Close to 80% of the venture capital pool in Hong Kong comes from non-Asian sources and over 90% of the disbursements are made to companies based outside Hong Kong. This contrasts with the pattern in other Asian markets – the average being 65% from local or other Asian sources and 60% to local companies. Indeed, Hong Kong is used by many international venture capital firms as a base to invest in Asia, particularly the Mainland. Hong Kong's attraction lies in its favourable regulatory and tax regimes, sound financial system and infrastructure, and position as a gateway to the Mainland.

5.10 At present, less than 10% of Hong Kong's venture capital disbursements have been made to Hong Kong-based companies. Most of these are mature companies seeking expansion rather than young companies seeking to commercialise innovative ideas or new technology. The relatively low venture capital investment in Hong Kong may have been due to insufficient good local opportunities vis-à-vis the Mainland and some other Asian economies²¹. The absence of a convenient exit for such investment may also be a contributory factor²².

5.11 Having regard to this gap and with the aim of fostering technology entrepreneurship, the Government has established the ARF scheme²³ to supply equity capital directly to technology-based firms. We believe that the ARF could be used also as a leverage to induce private venture capital investment.

²⁰ Source : *Asia Venture Capital Journal*

²¹ There are encouraging signs that the environment is improving. For example, H&Q Asia Pacific, one of the largest private equity investment operations in Asia and with strong roots in the Silicon Valley, has pledged to target \$1.1 billion for investment in Hong Kong's high-tech companies over the next four years.

²² This issue is discussed in paragraph 5.14.

²³ See paragraph 4.5 for a description of the ARF scheme.

At present, the three private venture capital firms appointed to run the ARF scheme are encouraged to co-invest with the Government in investee companies. We consider this a step in the right direction. We recommend that the Government explore the feasibility of setting up a co-investment scheme that provides government capital on a matching basis with private funds. The aim is to build up a substantial pool of private venture capital for the technology sector.

Equity Financing : Business Angels

5.12 'Business angels' are private investors providing equity capital directly to new or growing businesses in which they have no family connection. Research in the United States and Britain indicates that such informal venture capital is the single largest source of risk capital for entrepreneurial firms, substantially dwarfing the institutional venture capital industry²⁴. Investment by private investors occurs across all financing stages but is concentrated in start-up and early-stage expansion ventures.

5.13 *Some economies, e.g. the United States, Britain and Canada have established 'business angel networks' to facilitate networking between potential private investors and companies seeking finance. These networks typically operate on the basis of publishing an investment bulletin containing descriptions of companies seeking capital, which is circulated to investors registered with the network. Some networks do this also through electronic matching and investor forums. Some offer value-added services such as helping the companies concerned to prepare business plans. In practice, business angel networks have had mixed results. There does not appear to be any statistical data on Hong Kong's informal venture capital market. We suggest that the Government explore the need for introducing a similar network service in Hong Kong in due course. The co-investment scheme mentioned in paragraph 5.11 may help to induce business angel investment.*

²⁴ One study finds that in the United States the ratio of informal and formal venture capital in terms of dollars invested is 5 to 1, and 20 to 1 in terms of the number of ventures financed. Another study finds that in Britain the ratio of informal to formal venture capital is at least 2 to 1. Source : *Venture Capital and Innovation, OECD 1996*

Equity Financing : Public Listing

5.14 Firms may obtain equity capital through listing on the stock exchange. In general, this type of financing is more accessible to firms in the sustained-growth stage when they have a sufficient size and good track record. At present, companies seeking a listing on the Hong Kong Stock Exchange must attain at least \$50 million of profits in the three years prior to listing. In the last decade or so, many economies have established separate markets²⁵ for smaller companies that may not have a profit record but with good potential for growth. Such a market will also increase the liquidity of venture capital firms by providing a convenient exit for their investment. By the end of this year, a second board known as Growth Enterprise Market will be established in the Hong Kong Stock Exchange for the listing of smaller or emerging technology companies. This is a welcome step and we encourage the board to be set up as soon as possible.

Protecting Intellectual Property

5.15 Innovation, and R&D in particular, generates new ideas and processes that can be copied and exploited by competitors. An effective system for protecting intellectual property is indispensable for encouraging innovation. Such a system also enables wide diffusion of innovation without resort to secrecy.

Hong Kong's Intellectual Property Protection Laws

5.16 We appreciate the Government's ongoing effort to introduce a new body of intellectual property laws that will achieve the highest international standards. The laws on patent, copyright and designs were modernised in 1997. The Government is in the process of introducing a new, modernised law on trademarks.

5.17 Hong Kong must keep its intellectual property protection regime up-to-date with technological development. We note that new legislation has been enacted to protect intellectual property rights on layout designs of

²⁵ Examples are Japan, Korea, India, Singapore, Malaysia and Taiwan.

integrated circuits and new plant varieties. The new copyright law protects works distributed over the Internet, as well as creates civil liability on commercial dealings with devices designed to circumvent copy-protection and tampering with electronic right-management information systems ²⁶. Under the proposed new trademark law, sound and scent may also be accepted for registration as trademarks.

5.18 We suggest that the Government keep up these efforts so as to maintain Hong Kong as a good place for innovation and commercialisation of technology.

Enforcement

5.19 By and large, Hong Kong's well-established judicial and arbitration systems can deal with the civil side of intellectual property protection effectively. On the criminal side, in response to a rising tide of copyright and trademark infringements in recent years, the Government has increased substantially both the manpower for enforcement and the remedies against the production and sale of infringing products. It has also enacted new legislation to control the manufacture of optical disks to tackle an important form of copyright piracy at the production level. Notwithstanding these efforts, infringement of copyright and, less so, counterfeiting continue to be a cause for concern.

5.20 Copyright infringement hampers the growth of Hong Kong's film, musical entertainment and software industries, among others. Software piracy, for example, discourages the development of quality indigenous software meeting local customer needs. This in turn could have a bearing on the wider application of information technology in Hong Kong. The rampant sale of infringing goods also affects adversely the image of Hong Kong. We suggest that the Government continue to be vigilant in combating infringements of intellectual property rights.

²⁶ Hong Kong is the first place in the world to introduce such legislation.

Public Education

5.21 To tackle intellectual property right infringement at source, Hong Kong must promote respect for intellectual property through education, particularly among young people at school. We note that the Government has already directed some efforts at this in collaboration with the private sector and educational institutions. We suggest that such efforts be substantially strengthened.

5.22 We suggest that the universities consider reinforcing the teaching of intellectual property as part of the training for future scientists, engineers and business executives, e.g. using the patent system to assist in research and in sourcing technology.

5.23 *We note that SMEs generally suffer from a lack of understanding on the way the intellectual property system operates and a consequent failure to use it strategically, say, in applying for protection or in collaboration with larger companies. There is a need to target greater publicity and educational efforts at SMEs.*

Patents

5.24 To encourage local inventors to capitalise on their intellectual work through patent registration, the Government introduced a Patent Application Grant scheme in 1998. Under this scheme, a grant of not more than \$100,000 or 90% of the total direct costs of a patent application, whichever is the lesser, may be provided to a local company or individual who is not already a patent owner. The scheme is well received and most of the funding of \$12 million has been committed to over 100 patent applications. We recommend the Government to continue to fund the scheme using resources from the ITF.

5.25 Patent offices around the world hold and publish information about the inventions they are protecting. These collections are treasure houses of ideas. Information on patents in many of the more important depositories, e.g. in the United States, Japan, China, and Europe, is available on CD-ROM or accessible through the Internet. A number of chambers of commerce, professional bodies as well as the HKPC provide help services on patent searching. At present, the Government provides Hong Kong patent information to the public free of charge through CD-ROM. We suggest that the feasibility of making Hong Kong patent information available on the Internet be explored.

CHAPTER SIX

**SETTING UP OF
INNOVATION AND TECHNOLOGY FUND
AND
APPLIED SCIENCE AND TECHNOLOGY
RESEARCH INSTITUTE**

(This Chapter sets out the essential details of the Innovation and Technology Fund and the Applied Science and Technology Research Institute developed in the second phase of our work.)

6.1 In the first phase, we recommended the basic principles and broad framework for the establishment of the ITF and ASTRI. In view of the pivotal role of these two recommendations in promoting innovation and technology upgrading, we requested the Government to keep us closely informed of the development of detailed plans for their establishment. We advised on these plans as they were developed. We set out below their essential details, which have our endorsement.

Innovation and Technology Fund

6.2 The ITF underlines the Government's commitment to the promotion of innovation and technology upgrading in Hong Kong by providing a secure and substantial source of funding for projects contributing to this cause.

6.3 The Government will establish the ITF as a statutory fund. We support this statutory approach which will give the ITF a clear identity, status and legislative backing commensurate with its public mission. We also endorse the Government's move to subsume entirely the ISF and Services Support Fund

(SSF) ²⁷ into the ITF. This will simplify administration and avoid possible confusion by project proponents.

Types of Projects to be Funded

6.4 The Government has proposed that the ITF should finance four broad categories of activity. These are –

(a) Innovation and Technology Support Activities

These activities include midstream/downstream R&D projects undertaken by universities, industry support organisations, trade associations, private enterprises, as well as the ASTRI. The results of these projects are generally expected to be non-proprietary and disseminated for the benefit of relevant industries.

(b) University-Industry Collaboration Activities

These are R&D projects undertaken jointly by private enterprises and local universities. The objective is to stimulate private sector interest in R&D through leveraging the knowledge and resources in the universities. Unlike R&D projects in category (a), where project results should in principle be disseminated to relevant industries, project results in this category can be proprietary. Thus, funding for projects in this category will be provided on a matching basis.

As a start, the Government will introduce under this category the following three schemes, which have been recommended in the First Report –

²⁷ The ISF finances projects contributing to the development of manufacturing industry or technology generally in Hong Kong. The SSF finances projects contributing to the development of Hong Kong's service industry. See Box 5-1 of the First Report for additional information.

- Teaching Company Scheme
- Joint-research Matching Grant Scheme
- Industrial Research Chair Scheme

Additional information about these schemes is at Annex G.

(c) General Support Activities

This category includes activities that contribute to fostering an innovation and technology culture in Hong Kong, and activities which are not directly related to innovation or technology upgrading, but which will be beneficial to the upgrading or future development of our manufacturing or service industry. Examples of activity in this category are conferences, exhibitions, promotional activities, studies and training, as well as the Patent Application Grant scheme.

(d) Technology Entrepreneurship Promotion Activities

This category includes activities that encourage or support people with both technology know-how and business ideas to develop technology-based businesses. In Chapter Four, we have recommended a Small Entrepreneur Research Assistance Programme to be financed from the ITF under this category.

Project Assessment, Monitoring and Evaluation

- 6.5 In the First Report, we have stressed the importance of effective project assessment, monitoring and evaluation to the success of the ITF. The Government has confirmed that it will put in place a robust review system to assess project proposals to be approved on a competitive basis. To ensure that project proposals are relevant to the needs of industry, there will be requirements for private sector support, either in cash or in kind, for projects applying for funds. We support these arrangements.

6.6 The Government will also introduce a series of measures for monitoring approved projects, including periodic progress reviews, mid-term evaluation as well as post-completion evaluation. In addition, the Government will review periodically the effectiveness of the ITF through impact studies and other means. These are consistent with our recommendation in the First Report.

6.7 The ITF is intended to be operational by autumn this year. We urge the Government to expedite its establishment and commissioning.

Applied Science and Technology Research Institute

6.8 The ASTRI will fill a crucial gap in the technological infrastructure of Hong Kong in the area of midstream R&D. We note the confusion in many quarters about the meaning of midstream R&D. We reproduce at Annex H an explanation of the different stages of activity in the R&D spectrum (which is annexed to the First Report), together with some examples of midstream R&D activities for reference.

6.9 Following the acceptance of the recommendation to set up the ASTRI, the Government appointed a Task Force comprising both government officials and experts in the private sector to formulate the essential conceptual and planning parameters pertaining to the establishment of the ASTRI. The Task Force submitted its recommendations in April 1999.

6.10 In summary, the Task Force's recommendations are as follows.

Mission

(a) The mission of the ASTRI will be –

- to perform relevant and high quality midstream R&D for transfer to industry;
- to enhance Hong Kong's technological human resource development;

- to be a focal point for attracting outside R&D personnel to work in Hong Kong;
- to act as a spawning ground for technology entrepreneurs;
- to promote greater application of technology in industry; and
- to provide a focal point for industry-university collaboration.

Research and Development Programme

- (b) The ASTRI's activities must be market-oriented and focused (i.e. it must get into no more than three or four broad R&D areas) in order to achieve the intended results and make a real contribution to Hong Kong's technological and economic development. It should initially undertake a suitable mix of short-term and longer term projects so that some visible results could be achieved soon to establish the ASTRI's credibility. In addition, the ASTRI should not just respond to immediate business concerns. It should also have an eye on work that will enhance the future competitiveness of industry.

Organisation and Management

- (c) The ASTRI should be established as a statutory body. Its management board should comprise people of high public standing from industry and academia. A system of expert advisory panels should be put in place to provide guidance on relevant areas of the R&D programme. The ASTRI must have a strong management team led by a high-calibre chief executive officer.

Interface and Linkage

- (d) The ASTRI should establish effective links with industry, academia and industry support organisations. In particular, it should leverage on resources available in local universities and industry support organisations. It should also establish links or partnership internationally and with relevant Mainland institutions.

Planning and Development

- (e) The ASTRI should have its own permanent building and facilities, to be located in the Science Park. A two-phase approach should be adopted in developing the ASTRI. Before the ASTRI operates from its own purpose-built premises two to three years down the road, it should begin operation by launching some R&D projects leveraging on the resources in the universities and on the Mainland.
- (f) It is necessary to appoint as early as possible a small executive team headed by the future chief executive officer to take forward detailed planning of the ASTRI.
- (g) The ASTRI's R&D personnel should be encouraged to spin off as entrepreneurs or join industry. Thus, they should generally be employed on contract to ensure a healthy turnover. The management of the ASTRI should have the flexibility to offer competitive remuneration to attract exceptionally high-calibre researchers.

Finance and Budget

- (h) The ASTRI must have adequate resources to get off the ground and be effective. Some indicative financial planning parameters have been formulated as a basis for further detailed planning.
- (i) The capital cost and recurrent core operating expenses of the ASTRI should be borne by the Government. In the initial stage of the ASTRI's development, a certain level of funding from the ITF should be earmarked

for the ASTRI's research projects each year, to be allocated by the ASTRI.

Performance Evaluation

- (j) Systematic indicators, in both qualitative and quantitative terms, should be devised by the management of the ASTRI to evaluate its performance. The ASTRI's contribution to the economy should not be measured by the narrow financial return on the public investment in it. Instead, it should be measured largely by the longer term social and economic benefits, such as creating new industries, upgrading existing industries, and fostering technology entrepreneurship.

6.11 The Government consulted us at the inception of the Task Force on the issues that it would address, and also on its recommendations after they had been submitted. We note that the Task Force has built on the First Report's recommendations on the broad framework of the ASTRI, and we endorse the general thrust of the Task Force's proposals. We wish to highlight the following points for the Government's attention in taking forward the planning of the ASTRI –

- *the objective of midstream R&D needs to be further clarified and explained to the public;*
- *while in principle the staff of the ASTRI should not be employed with tenure, there is a need for some core staff to be employed on a more permanent basis to provide continuity. The ASTRI should also have a flexible policy of hiring and firing;*
- *members of the ASTRI's management board should not have strong links with special interest groups to avoid undue influence by them in the formulation of the ASTRI's R&D programme;*

- *the ASTRI should aim to be resourced partly by industry rather than purely from the public purse;*
- *the ASTRI should pay special attention to technology supporting knowledge-based service industries, e.g. information technology; and*
- *the ASTRI should establish close partnership with research institutions on the Mainland and overseas.*

CHAPTER SEVEN

CONCLUDING REMARKS

7.1 Over the last 15 months, we have studied carefully every aspect of our charge, mapping out a blueprint of the steps needed to mobilise industry, academia, Government and the community to develop Hong Kong into a knowledge-driven and technology-intensive economy. In particular, we have recommended –

- Improved institutional arrangement for policy setting and co-ordination as well as for service delivery.
- Setting up the ASTRI to fill a crucial gap in Hong Kong's technological infrastructure.
- Establishing a substantial and secure source of public funding, in the form of the ITF, for the promotion of innovation and technology upgrading.
- Attracting talents from the Mainland and other places to build up Hong Kong's intellectual capital.
- Funding programmes to nurture technology entrepreneurship.
- Measures to encourage industry to tap the rich technological resources on the Mainland.
- Ways to promote industry-university partnership.
- Measures to foster an innovation and technology culture in industry and the community at large.

- Attention to be given to lowering administrative barriers, promoting competition, financing innovation and protecting intellectual property, which are essential for creating an enabling business environment.

7.2 Apart from highlighting some economic or technology areas that match the patterns of Hong Kong's competitive advantage, we have not addressed specific issues related to individual sectors. Such an exercise should more suitably be undertaken by experts and practitioners in the areas concerned. It would also have taken much more time than that available to us. In this report, we have recommended the Government to follow up on this aspect along with industry and academia.

7.3 Naturally one may ask whether our recommendations will work, and what differentiates them from those proposed or tried before. We consider that the two key factors are –

- a holistic and coherent approach to taking forward our recommendations, backed by clear and sustained commitment at all levels of the Government, in contrast to piecemeal measures and occasionally confused messages from the Government in the past; and
- the acceptance and active support by industry, academia and the community at large.

During our work, we have witnessed firm commitment from the Government right to the highest level and a great momentum for change in the community. We believe that these would make the difference.

7.4 Continued provision of adequate resources to support the cause is also essential. But we are firmly against throwing money at the problem indiscriminately. In the First Report and in this report, we have repeated the need for evaluation, accountability and effectiveness. Furthermore, industry must assume the primary role in enhancing the competitiveness of its products and services. While the Government may be involved more heavily at first to

jump-start the process of change, in the longer term industry should be responsible for the lion's share of the resources needed.

7.5 The submission of this Second and Final Report marks the completion of our task. But in a sense this is the beginning of Hong Kong's journey to build its new competitiveness in the knowledge-based, global economy of the 21st century. Much more needs to be done by the stakeholders and the whole community. We have no doubt that with resolve and confidence, Hong Kong will realise the vision of becoming an innovation and technology centre for South China and the region.

LIST OF ABBREVIATIONS

ARF	Applied Research Fund
ASTRI	Applied Science and Technology Research Institute
HKIB	Hong Kong Institute of Biotechnology
HKIEC	Hong Kong Industrial Estates Corporation
HKITCC	Hong Kong Industrial Technology Centre Corporation
HKPC	Hong Kong Productivity Council
HKSP	Hong Kong Science Park
HKTDC	Hong Kong Trade Development Council
Ind D	Industry Department
ISF	Industrial Support Fund
ITDC	Industry and Technology Development Council
ITF	Innovation and Technology Fund
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
SERAP	Small Entrepreneur Research Assistance Programme
SMEs	Small and medium-sized enterprises
SSF	Services Support Fund
VTC	Vocational Training Council

ACKNOWLEDGEMENTS

Many organisations and individuals have given feedback and suggestions to us through written representations, electronic mails, and other means. We thank them for their useful input to our deliberation.

We are indebted to all the participants to our workshops, especially the panellists for sharing their insightful opinions with participants.

Our special gratitude goes to the seven technology-based companies which took part in the joint press conference organised by us in February. By announcing their expansion plan in or renewing their commitment to Hong Kong, they cast a strong vote of confidence in Hong Kong's vision.

We wish to underline the significant contribution of the media in bringing about the momentum for change in the community over the past year. We have been heartened by their support for the cause and generous coverage of the Commission's work.

We are grateful to all the Government bureaus, departments and agencies which have given valuable views or assistance to us. We thank especially the Information Services Department, the Official Languages Agency and the Printing Department for their professional support services.

Finally, we wish to record our appreciation of the sterling support provided throughout by the secretary and other staff of the Commission.

Terms of Reference of the Commission

To advise the Chief Executive on -

1. the steps that Hong Kong should take; and
2. the institutional arrangements that are needed to -
 - (a) stimulate the exchange of ideas between university researchers, businessmen, industrialists and customers so as to drive forward innovation and turn technological development into commercial products;
 - (b) tap the talents and the results of scientific research in the Mainland; and
 - (c) make Hong Kong an innovation centre for South China and for the region, adding value to our commercial and industrial activities and to our economic hinterland.

Membership of the Commission

Chairman

Professor Chang-Lin TIEN
NEC Distinguished Professor of Engineering
University of California, Berkeley

Members

Mr Payson CHA Mou-sing
Managing Director
HKR International Limited

Professor Leroy CHANG Li-gong
Vice-President for Academic Affairs
Hong Kong University of Science and Technology

Mr CHAU Tak Hay
Secretary for Trade and Industry
Government of the Hong Kong Special Administrative Region

Mr Vincent CHENG Hoi-chuen
Vice-Chairman and Chief Executive
Hang Seng Bank Limited

Mr Francis HO Suen-wai
Director-General of Industry
Government of the Hong Kong Special Administrative Region

Professor Charles KAO Kuen
Chairman and Chief Executive Officer
Transtech Services Limited

Professor LIU Pak-wai
Pro-Vice-Chancellor and Professor of Economics
Chinese University of Hong Kong

Mr Victor LO Chung-wing
Chairman and Chief Executive
Gold Peak Industries (Holdings) Limited

Professor LU Yong-xiang
President
Chinese Academy of Sciences

Mr Henry TANG Ying-yen
Managing Director
Peninsula Knitters Limited

Dr WANG Mei-yue
Consultant of the Board
China Aerospace International Holdings Limited

Mr Allan WONG Chi-yan
Chairman
VTech Group of Companies

Professor Richard WONG Yue-chim
Director, School of Business and
Hong Kong Centre for Economic Research
University of Hong Kong

Written Representations to the Commission

Organisations

3M Hong Kong Limited

Booz Allen & Hamilton

Business and Professionals Federation of Hong Kong

China (HK) Professionals Association Ltd

Hong Kong Article Numbering Association

Hong Kong Association for the Advancement of Science and Technology Ltd, The

Hong Kong Biotechnology Association Limited, The

Hong Kong Customer Service Consortium Ltd

Hong Kong Electronic Industries Association Ltd, The

Hong Kong General Chamber of Commerce, The

Hong Kong Institution of Engineers

Hong Kong Intelligent Transportation System Promotion Group

Hong Kong Polytechnic University, The

Lam Soon (Hong Kong) Limited

Satellite Television Asian Region Limited

Individuals

Cheng Yiu Tong

Tony R Eastham, Professor

Peter Gordon

Lam Chat-yu, Dr

Lam Chiu Chiu

Philip Y T Lam

Law Chiu Ning

Li Ping-wai, Dr

Yi Li, Dr

Anson Wang

Raymond S K Wu

Lloyd Yam, Dr

Eric Yuen

Annex D

Outreach Activities of the Commission

Roundtable Workshop with Business and Academic Leaders

Date : 12 October 1998

Theme : The Commission' s First Report and Work in Second Phase

Third Workshop on Innovation and Technology

Date : 16 December 1998

Panellists : Concurrent Session A : Stimulating Venture Capital Investment in Early-Stage Companies

Mr Cliff L Cheung
Chairman
Hong Kong Venture Capital Association

Mr Victor Kung
Executive Vice-President
Walden International Investments Group

Professor Sunny Kwong
Department of Economics
Chinese University of Hong Kong

Mr Cheung Chee Wah
Director
Compass Technology Co Ltd

Concurrent Session B : Upgrading Traditional Industry
through Innovation and Technology

Mr Jeffrey Lam
Managing Director
Forward Winsome Industries Ltd

Mr Peter Wang
Managing Director
Hwa Fuh Manufacturing Co (HK) Ltd

Professor Otto Lin
Vice-President for Research and Development
Hong Kong University of Science and Technology

Mr Thomas Tang
Executive Director
Hong Kong Productivity Council

Concurrent Session C : Fostering Growth of Venture Businesses

Dr James Liu
Chief Executive Officer
Hong Kong Industrial Technology Centre Corporation

Dr Albert Chang
Director
Hong Kong Institute of Biotechnology

Professor Po S Chung
Vice-President
City University of Hong Kong

Mr Thomas Wan
Chief Executive Officer
Valence Technology Inc

Fourth Workshop on Innovation and Technology

Date : 14 January 1999

Theme : Building up Human Capital for Knowledge Economy

Panellists : Professor Cheng Kai-ming
Pro-Vice-Chancellor
University of Hong Kong

Mr Joe Yiu
Vice-President and General Manager, Asia Pacific Region
Motorola Semiconductor Products Sector

Dr York Liao
Executive Director
Varitronix Ltd

Dr Wang Mei-yue
Member of the Commission
(Represented by Mr Chen Shu Kang
Executive Director and Vice-President
China Aerospace International Holdings Ltd)

Roundtable Workshop with Industry and Technology Development Council

Date : 15 January 1999

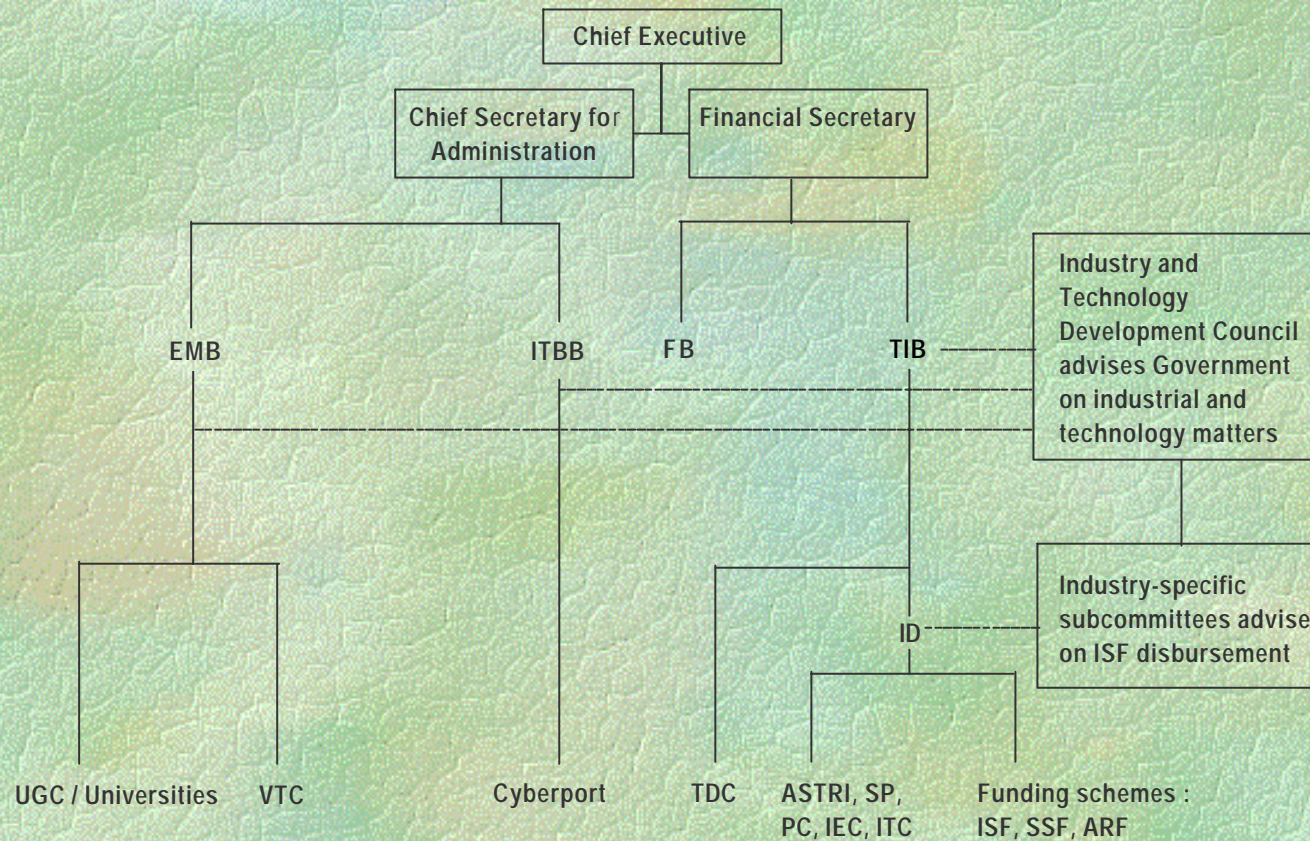
Theme : Future Institutional Arrangement for Promoting Innovation and Technology

Roundtable Workshop with Non-government Public Institutions

Date : 22 March 1999

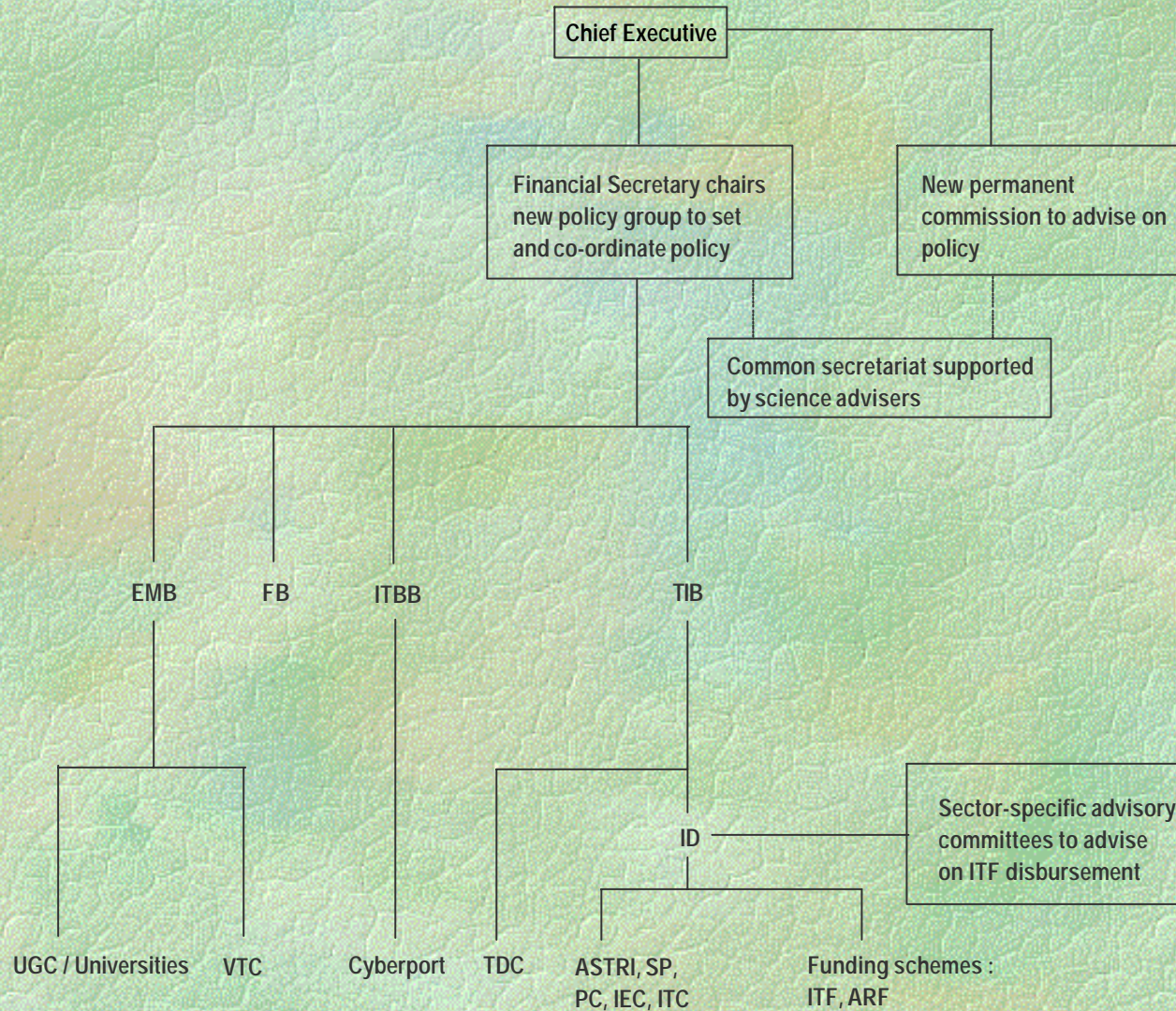
Theme : Role and Functions of Non-government Public Institutions
Supporting Technology Application, Commercialisation and Development

Existing Government Institutional Setup for Promoting Innovation & Technology

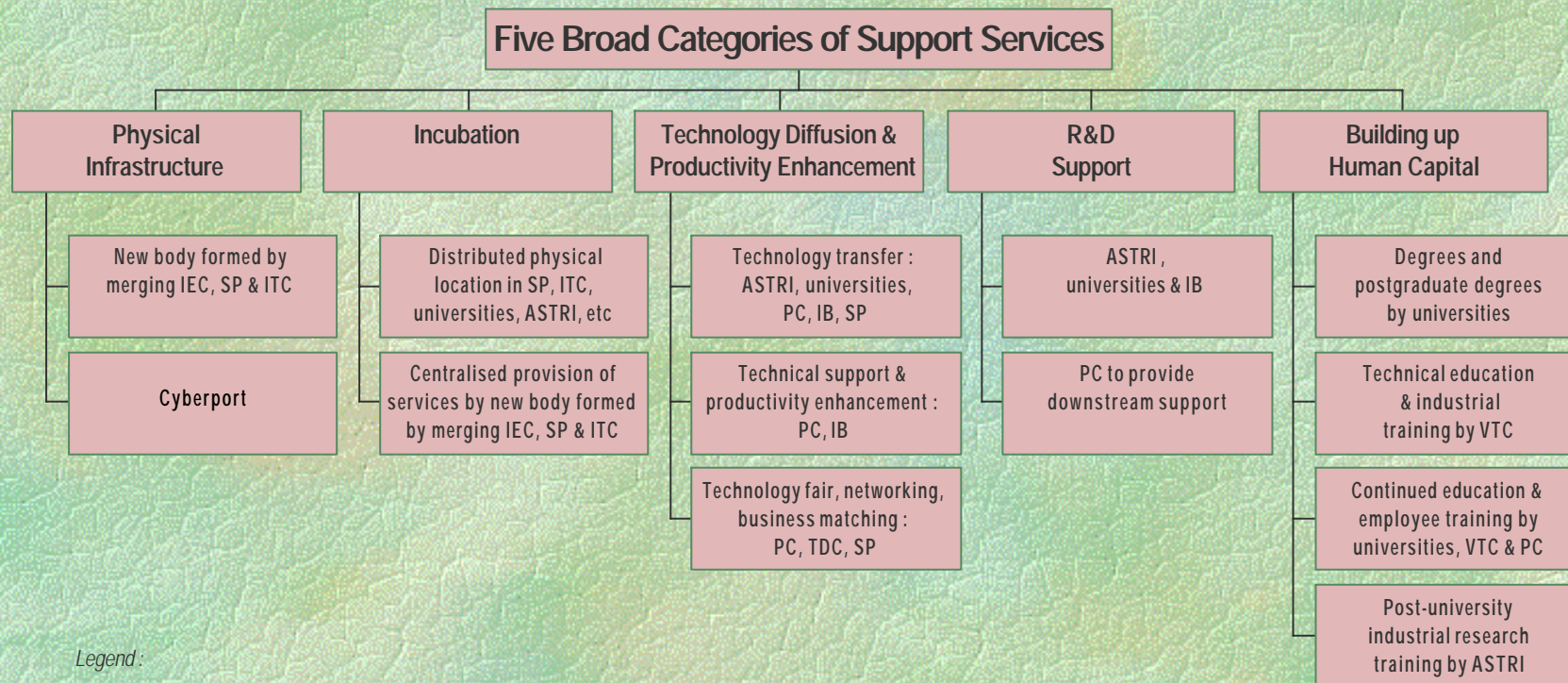


<i>Legend :</i>	TIB	Trade and Industry Bureau	PC	Productivity Council
	FB	Finance Bureau	SP	Science Park
	ITBB	Information Technology and Broadcasting Bureau	TDC	Trade Development Council
	EMB	Education and Manpower Bureau	VTC	Vocational Training Council
	ID	Industry Department	ARF	Applied Research Fund
	UGC	University Grants Committee	ISF	Industrial Support Fund
	ASTRI	Applied Science and Technology Research Institute	ITF	Innovation and Technology Fund
	IEC	Industrial Estates Corporation	SSF	Services Support Fund
	ITC	Industrial Technology Centre		

Proposed Government Institutional Setup for Promoting Innovation & Technology



Non-government Public Institutions : Division of Responsibility for Service Delivery



Legend :

ASTRI Applied Science and Technology Research Institute
 IB Institute of Biotechnology
 IEC Industrial Estates Corporation
 ITC Industrial Technology Centre

PC Productivity Council
 SP Science Park
 TDC Trade Development Council
 VTC Vocational Training Council

Annex G

Brief Description of Teaching Company Scheme, Joint-research Matching Grant Scheme and Industrial Research Chair Scheme

Teaching Company Scheme

This scheme is modelled on an existing Industrial Support Fund project carried out by the Hong Kong Polytechnic University. Participating companies will hire graduate research students in local universities to take up specific R&D projects with a finite duration. The university will provide teaching guidance for the student in working on the project. Participating companies and the Government will each bear half of the cost for hiring the student.

Joint-research Matching Grant Scheme

This scheme provides matching grants to private enterprises undertaking proprietary R&D projects in collaboration with local universities. The participating company will bear half of the cost of the project. The ownership of and access to the intellectual property resulting from the project will be agreed between the company and the university before the project commences.

Industrial Research Chair Scheme

This scheme assists local universities and industry to develop research efforts in technology fields that are not yet developed in Hong Kong but which have good development potential in the longer term. A grant matching the contribution of industry will be provided to the participating university to cover the salary and other costs of the research chair-holder concerned for a

finite duration. This chair-holder will mainly conduct research and will accept a light teaching load.

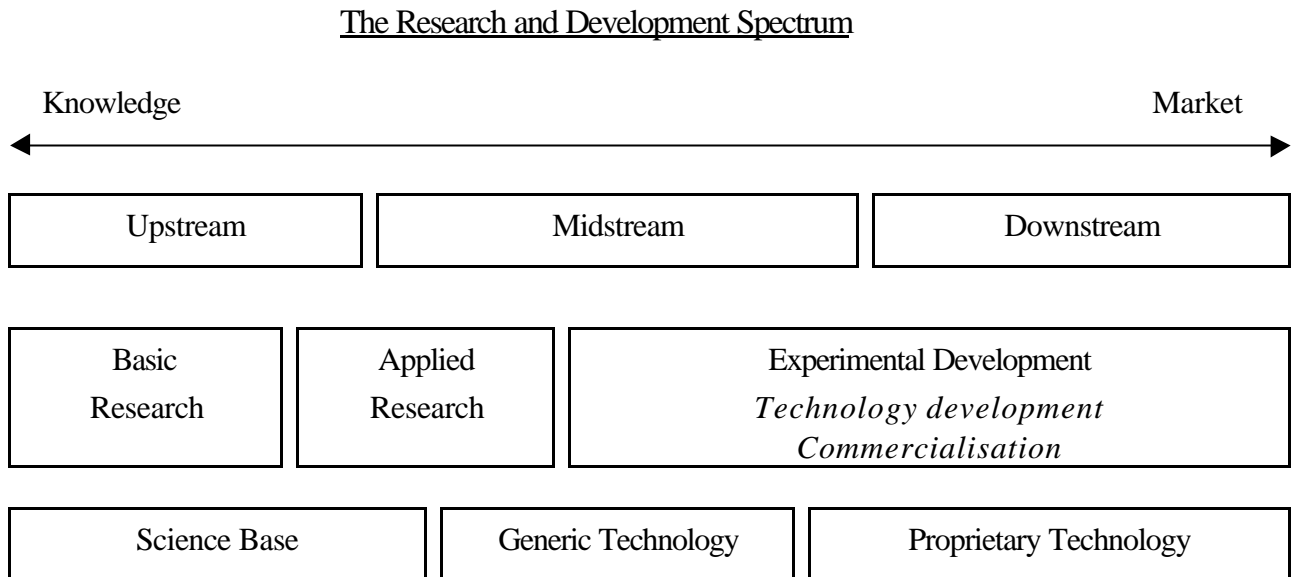
Annex H

Types of Research and Development Activities

There are different ways of classifying R&D activities. For example, the Organisation of Economic Co-operation and Development classifies R&D activities broadly into three types (*the Frascati Manual, 1994*) – basic (or fundamental) research, applied research and experimental development – with their definitions as follows -

- **Basic Research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.
- **Applied Research** is original investigation undertaken in order to acquire new knowledge which is directed primarily towards a specific practical aim or objective.
- **Experimental Development** is systematic work, drawing on existing knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

A schematic diagram of the different stages of activity in the R&D spectrum is set out below for reference.



Examples of Midstream Research and Development Activities

Three simple examples of midstream research and development work are given below. Two are being funded by the Industrial Support Fund (ISF) and undertaken by local universities. The third example also illustrates the transfer of midstream research outcome to industry through downstream support by the Hong Kong Productivity Council (HKPC).

Example 1 - Novel Polymers for Biomedical Application

Researchers in a local university have developed a new kind of synthetic polymer gel that contracts at body temperature at a rate much faster than any other known material. The gel is also much stronger. This innovative development has been confirmed scientifically and patent application filed. The ISF is funding further laboratory research to examine the technical feasibility of applying this new material to human tissue surgery (e.g. for mending human organs or bones).

If this midstream work is successful, additional research and product development work will be needed to turn the new material into a commercial biomedical product. Issues to be addressed include evaluation of merits relative to existing products, safety, clinical trial, production process development and so on.

Example 2 - 2.4 GHz Spread Spectrum High Fidelity Wireless Audio System

Based on generic research in integrated circuit design, wireless communications and digital signal processing, researchers in a local university are researching and designing specific integrated circuits and other components for a high data-rate system, for application in a near-Compact Disc quality audio signal transmission and reception system using the 2.4 GHz frequency band. The research project is funded by the ISF.

The results of this midstream work may be commercialised in products such as a wireless stereo system that transmits multi-channels of high-fidelity music to speakers at multiple locations within a building.

Example 3 - Surface Treatment and Coating Technology for Titanium Alloy

Research on titanium alloy and properties of different alloy formulations is basically upstream. Based on such research, surface treatment and coating technology have been developed to apply titanium alloy to consumer products. This is within the realm of midstream work. The HKPC, under sponsorship of the ISF, is adapting such technology (e.g. optimising process parameters) for local industry, such as for production of watches and spectacle frames.

Annex I

Staff of the Commission

<u>Secretary</u>	Mr Kenneth MAK Ching-yu
<u>Assistant Secretary</u>	Mr TONG Fu-keung
<u>Executive Officer</u>	Miss Shirley LEE Yik-fung
<u>Personal Secretaries</u>	Ms Jackie CHEUNG Wan-ha Ms Mandy WONG Sau-king

Assistant Clerical Officer Mr David CHEUNG Chun-keung

Representative from Trade and Industry Bureau

Miss CHEUNG Siu-hing

Representatives from Industry Department

Miss Annie TANG Hoi-yee

Ms Annie CHOI Suk-han