Consultation Paper

New Strategy of Innovation and Technology Development

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Innovation and
Technology Commission

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CONTENTS

FOREWORD

Innovation and technology play an important role in enhancing the productivity and competitiveness of an economy. Experience of various economies shows that innovation and technology have been crucial factors in sustaining long-term economic growth.

This consultation paper outlines the current state of innovation and technology development in Hong Kong, the issues and challenges for promoting technological innovation, and the proposed new direction and initiatives to address such issues and challenges. As part of the new strategy to promote the development of innovation and technology, the Government proposes to identify technology focus areas and set up research and development (R&D) centres in the selected focus areas. The new strategy aims to improve the relevance of applied R&D to the needs of the industry and to strengthen the coordination among different elements of the innovation and technology programme.

This consultation paper invites views and comments[Note] on the new strategy of innovation and technology development, particularly the proposed technology focus areas and the proposed approach in coordinating R&D efforts.

Interested parties are requested to send their views in writing by mail, fax or email **on or before 31 August 2004** to:

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This consultation paper is available at the following websites : www.info.gov.hk/itc/eng/itconsultation (for English version) and www.info.gov.hk/itc/chi/itconsultation (for Chinese version).

[Note] Any person submitting views and comments should be aware that the Government may publish all or part of the views and comments received and disclose the identity of the source in such manner as the Government considers appropriate, unless he/she requests any part of the views and comments and/or his/her identity be treated in confidence.

EXECUTIVE SUMMARY

Innovation is the key driver of economic growth while technology is a powerful force for innovation. Hong Kong has been promoting the development of innovation and technology, mainly through the funding of applied research and development (R&D) projects and the provision of infrastructural support.

2. The Government has recently conducted a review of the development of innovation and technology in Hong Kong. On the demand side, we have a strong base of foundation industries extending beyond Hong Kong into the Pearl River Delta region (PRD). The room for technology upgrading of the 60 000 strong Hong Kong-related enterprises in the PRD is tremendous, and such upgrading would help enhance their value-adding capability and competitiveness. The Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA) may also attract to Hong Kong the manufacturing of products with high value-added content or substantial intellectual property input.

3. Through the Government's efforts in project funding and infrastructure development over the past few years, we have witnessed the strengthening of research capabilities in Hong Kong and increased spending in R&D activities in the business sector. Since its launch in November 1999, the Innovation and Technology Fund (ITF) had supported more than 500 projects at a total funding of $1.53 billion. According to the findings of a recent survey commissioned by the Innovation and Technology Commission, each ITF project has on average generated 1.3 technologies or products, and 0.55 patent has been filed per project and 0.15 patent has already been granted per project. However, it is also noted that since the ITF has largely been based on a bottom-up approach, i.e. mainly initiated by individual researchers and research groups, it is not very conducive to building significant focus and clusters. To further promote the development of innovation and technology, Hong Kong should capitalize on its existing strengths, bridge the gap between research capabilities and industry needs, and utilize the production base in the Greater PRD as the platform for developing its applied R&D and commercialization of applied R&D deliverables.

4. Taking into account the current economic landscape and having reviewed the existing innovation and technology programme, the Government proposes to adopt a new strategy of innovation and technology development which emphasizes on five key elements, i.e. focus, market relevance, industry participation, leverage on the Mainland, and better coordination among different elements of the innovation and technology programme.

5. The key initiative of the new strategy is to identify technology focus areas for future development. We propose that after the identification of focus areas, R&D Centres would be set up to drive and coordinate R&D efforts and promote commercialization of R&D results in the selected focus areas. The proposed R&D Centres would be responsible for developing core competencies in specific focus areas, acting as focal points for conducting applied R&D and providing platforms for commercialization of applied R&D deliverables. To ensure the optimal use of resources, the Government plans to support no more than one R&D Centre in each focus area. ITF resources would in future mainly be deployed to support the establishment and R&D programmes of these R&D Centres.

6. As the new strategy emphasizes on market relevance and industry participation, we have been adopting a market-driven, demand-led approach in identifying possible focus areas. The goal is to identify technology areas where Hong Kong has comparative advantages and has the potential for meeting industry and market needs. After our preliminary consultation with the industry, universities, innovation and technology organizations and other stakeholders in the past six months, we have identified the following 13 proposed technology areas for further consideration -

(a) Advanced Manufacturing Technologies
(b) Automotive Parts and Accessory Systems
(c) Chinese Medicine
(d) Communications Technologies
(e) Consumer Electronics
(f) Digital Entertainment
(g) Display Technologies
(h) Integrated Circuit Design
(i) Logistics/Supply Chain Management Enabling Technologies
(j) Medical Diagnostics and Devices
(k) Nanotechnology and Advanced Materials
(l) Opto-electronics
(m) Textile and Clothing

7. The Government would like to seek the public's views on the proposed focus areas and setting up of R&D Centres. Based on the feedback

received during the two-month consultation period from July to August 2004, the Government will draw up the list of technology focus areas and invite proposals for setting up R&D Centres. Depending on the number of focus areas, the Government may invite proposals in phases.

8. While the exact mode of operation of each R&D Centre would depend on the nature of the focus area and the proposals received, proposals for hosting R&D Centres should cover several key issues such as the relationship between the host institution and the R&D Centre, organizational structure and staffing, R&D programme and funding required, format of industry participation and issues relating to intellectual property rights.

9. To facilitate the Government in assessing the level of interest in hosting and supporting an R&D Centre under a particular focus area, we would also like to invite expressions of interest from research institutions and other relevant stakeholders, with preliminary proposals indicating the commitment of the host institution, a roadmap of the technology development of the focus area and the mode of cooperation with other institutions and the industry.

CHAPTER ONE

Innovation and Society

Innovation

1.1 Innovation can be generically defined as the successful implementation of new ideas from which commercial values are generated. It is pervasive and diverse, and is usually associated with, but not limited to, technological advancement. According to the Organization for Economic Co-operation and Development (OECD), technological innovations comprise new products and processes as well as significant technological changes in products and processes. Innovations may be introduced on the market (product innovation) or used within a production process (process innovation). Innovations therefore involve a series of scientific, technological, organizational, financial and commercial activities[1].

1.2 Innovation can also take different forms, ranging from radical innovations that create wholly new products, processes and services to incremental innovations that improve upon existing offerings in a more modest way.

1.3 In the context of this consultation paper, innovation covers three types of activities –

(a) manufacturing process improvement or innovation (to increase productivity) through technological advancement;

(b) innovation to increase value-added through new markets, product and services; and

(c) scientific and technological progress leading to new (or improved) enabling technologies.

All these innovation activities share a common goal – to promote economic growth through improved performance and enhanced competitiveness.

[1] OECD, Oslo Manual 2nd edition, 1996.

Research and Development

1.4 Research and development (R&D) is a vital source of innovation. It stimulates innovations, fosters innovative activities, and leads to the creation of new products, new services, new processes and new markets. R&D comprises basic research, applied research and experimental development. The more downstream the R&D activities are, the closer they are to market needs and the more opportunities may be available to commercialize the R&D results. In the context of this consultation paper, R&D activity refers to applied research and experimental development that stimulate innovation.

1.5 The importance of innovation at the corporate level can be reflected from the result of the Community Innovation Survey (CIS) [2] 1997-1998, undertaken jointly by the European Commission and the statistical offices of the European Economic Area's Member States. The CIS indicates that over half of the European manufacturing enterprises (51%) and 40% of those in the service sector are technological innovators, i.e. these firms have introduced a technologically new product, process or service over a three-year surveyed period[3].

1.6 Numerous studies conducted on the industrialized nations provide evidence that a strong correlation exists between investments in R&D and productivity and economic growth[4,5]. Many studies have demonstrated that investments in R&D yield high returns to investors and even higher returns to society due to spillover effects[6,7].

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[2] CIS is a periodic survey of businesses designed to measure innovation activity, sources of innovation, knowledge transfer and the effects of innovation on businesses. It is a survey coordinated by the European Commission with the support of the Member States.

[3] European Commission, "Building an Innovative Economy in Europe: A review of 12 studies of innovation policy and practice in today's Europe", 2001.

[4] Guellec and van Pottelsberghe, "R&D and productivity growth: panel data analysis of 16 OECD countries", OECD Economics Studies No. 33, 2001.

[5] OECD, "Science, technology and industry outlook: Drivers of growth: information technology, innovation and entrepreneurship", 2001.

[6] Jones and Williams, "Measuring the social rate of return to R&D", *Quarterly Journal of Economics,* vol. 113(4), 1998; Griliches, Z., "The search for R&D spillovers", *Scandinavian Journal of Economics, vol. 94, pp. 29-47*, 1992.

[7] Spill-overs means that an individual firm or innovator will realize only a fraction of the total returns to an innovation; that is, the innovation yields benefits to others for which the original researcher is not fully aware of nor compensated. The innovation has spread through imitation or adaptation by other firms.

CHAPTER TWO

Innovation and Technology Development in Hong Kong

Innovation and Technology Programme

2.1 The role of Government in promoting innovation and technology was expounded by the reports submitted by the Chief Executive's Commission on Innovation and Technology in 1998 and 1999. The Commission recommended that the Government could play the role of a promoter, facilitator and supporter and proposed a five-point strategy for the Government to promote innovation and technology in Hong Kong -

- strengthen technological infrastructure and promote technological 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; and
- lower information, financing and regulatory barriers.[8]

2.2 The Government has accepted the recommendations and has been implementing the above strategy in the past five years through the innovation and technology programme which includes the following elements -

(a) Innovation and Technology Fund

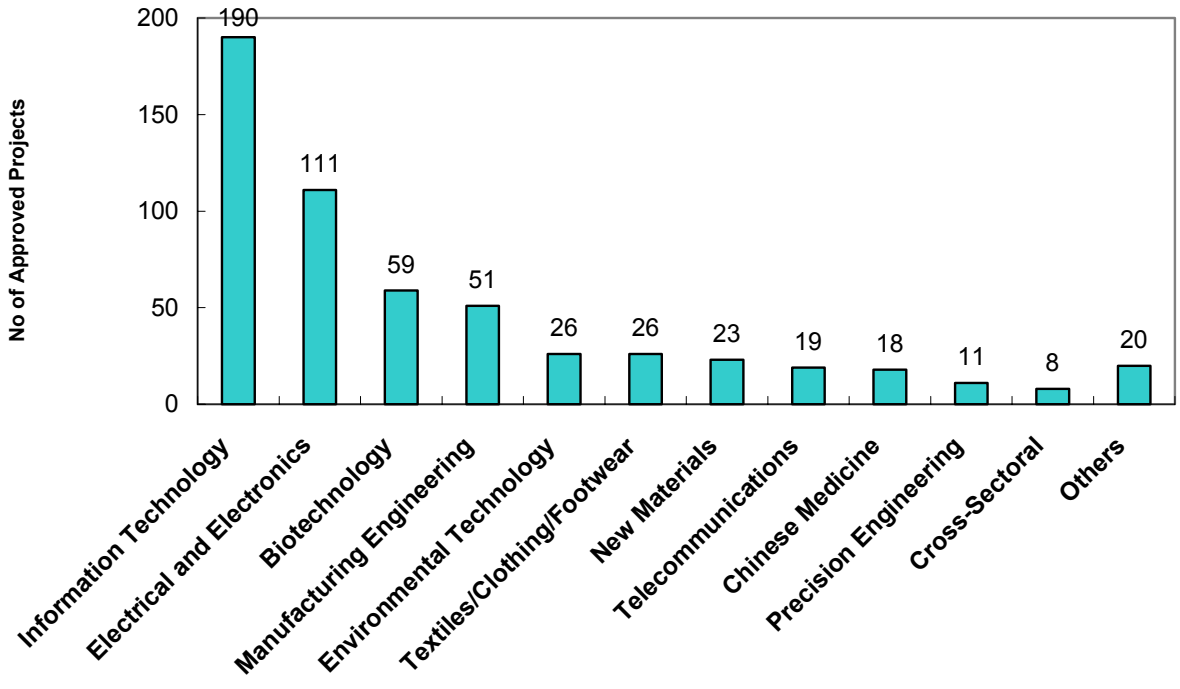
2.3 The $5 billion Innovation and Technology Fund (ITF) was launched on 1 November 1999 to finance projects that contribute to innovation or technology upgrading in industry, as well as those that contribute to the development of industry. There are four programmes under the ITF with different purposes, namely the Innovation and Technology Support Programme (ITSP), University-Industry Collaboration Programme (UICP), General Support

[8] Paragraph 4.14 of the First Report of the Chief Executive's Commission on Innovation and Technology published in September 1998.

Programme (GSP) and Small Entrepreneur Research Assistance Programme (SERAP). As at end March 2004, the ITF had supported 562 projects at about $1.53 billion (Figure 2.1).

2.4 One of the parameters in assessing the impacts of the ITF is the amount of private sector contribution to R&D activities. Before the introduction of the ITF in November 1999, the total amount of private sector contribution to R&D as reflected by the matching funds for the then Industrial Support Fund (ISF) and Services Support Fund (SSF) was about $24 million per annum. Since the launch of the ITF, the total amount of private sector contribution has increased to an average of $177 million per annum. During the respective periods, the average annual amount of ISF/SSF and ITF funding provided was $295 million and $375 million respectively.

Figure 2.1 Sectoral Breakdown of the 562 Approved ITF Projects (involving total funding of $1.53 billion as at end March 2004)



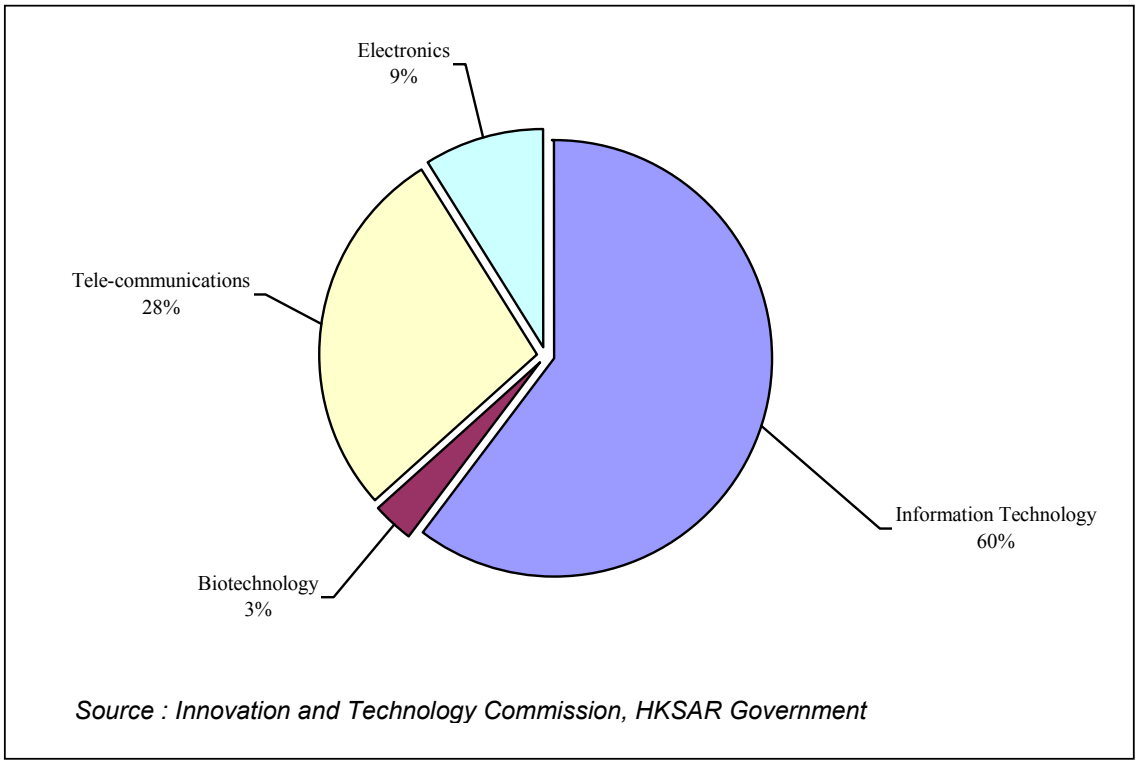
Source: Innovation and Technology Commission, HKSAR Government

(b) Applied Research Fund

2.5 Apart from the ITF, the Government has been operating the Applied Research Fund (ARF) to provide funding support to technology ventures and R&D projects that have commercial potential. The longer-term aim is to increase the technological capability and to enhance the competitiveness of local industry, thereby promoting high value-added economic development in Hong Kong.

2.6 The ARF is controlled and administered by the Applied Research Council (ARC), a company wholly owned by the Government and formed specifically for this role. The ARC started to engage private sector venture capital firms as ARF's fund managers in November 1998. As of end March 2004, the ARF has supported a total of 23 projects through fund managers with approved funding of $378 million (Figure 2.2).

Figure 2.2 The projects funded by the ARF (via fund managers) broken down by industry sector



Source : Innovation and Technology Commission, HKSAR Government

(c) Applied Science and Technology Research Institute

2.7 The Applied Science and Technology Research Institute (ASTRI) was established in 2000 to perform high quality R&D for transfer to industry and act as a spawning ground for technology entrepreneurs. As at end March 2004, the ASTRI has carried out 22 R&D projects in four technology areas at a total funding of $179 million.

2.8 One of the projects, which was to develop a technology to enable interactive learning of spoken English on Internet, was completed in 2003 and successfully licensed to several local companies to develop various hardware and software educational products. The ASTRI has recently completed three projects on photonics packaging technology and commercialized the technologies with more than $109 million income to ASTRI, plus an annual royalty for three years.

Box 2.1 Commercialization of Photonics Technology developed by ASTRI

- On 21 April, 2004, the ASTRI and SAE Magnetics (H.K.) Ltd. (SAE) jointly announced a transaction whereby ASTRI sells its photonics packaging technologies and related assets to SAE to form a new photonics business in Hong Kong through its subsidiary, Acasia Technologies (HK) Limited. The deal brings more than $109 million to ASTRI, plus an annual royalty for three years. The gross income from the projects is estimated to be about three times the project funding from the ITF.

- ASTRI's photonics work has resulted in the successful development of high data-rate optical transceiver subassembly packaging technologies which are best suited for broadband applications that demand fast and secure exchange of data between computers and the enterprise storage system. Such photonics products can help bring down the cost of data management in enterprises.

- The deal between SAE and ASTRI will help create a new photonics industry in Hong Kong which in turn will encourage the formation of new supporting industries, thereby creating a clustering effect and high-tech employment opportunities in Hong Kong as well as building up local technology talents.

(d) The Hong Kong Science and Technology Parks Corporation

2.9 The Hong Kong Science and Technology Parks Corporation (HKSTPC) is another flagship technology infrastructure. It provides a comprehensive range of services to cater for the needs of industry at various stages, ranging from nurturing technology start-ups through the incubation programme, providing premises and services in the Science Park for applied R&D activities, to providing land in the industrial estates for production.

2.10 In December 2003, the HKSTPC opened its Integrated Circuit (IC) Design and Development Support Centre providing one-stop solution services to IC companies throughout the entire product development cycle. The centre fosters the growth of the IC design industry through providing quality infrastructure and shared support facilities and provision of services. As at end March 2004, 22 companies approved for admission into the Science Park (out of a total of 55) belong to the IC cluster.

2.11 The HKSTPC is also establishing a Photonics Development Support Centre with comprehensive analysis equipment facility and provision of testing services to support the design, evaluation and qualification of sub-component, component or micro-device with ultra small structure.

(e) Cyberport

2.12 The Cyberport is a major infrastructure project providing state-of-the-art information technology, telecommunications and digital media facilities with a view to creating a strategic cluster of IT companies and to supporting and facilitating development of new technologies, applications, services and content. Apart from leasing and recruitment of tenants, Cyberport is also intensifying its efforts to sharpen the technology focuses and promote wider industrial application in the relevant sectors.

2.13 To provide a platform for development of wireless applications, solutions and services, the Government is supporting the Hong Kong Wireless Technology Industry Association to operate a wireless development centre at the Cyberport with funding from the ITF. A digital media centre has also been set up at the Cyberport to provide hardware, software, technical and marketing support to industry in computer graphics and animation and in the production of films and games. Multi-media content creators can make use of the centre facilities on a

time-sharing basis without the need to invest in their own expensive equipment initially.

(f) Hong Kong Productivity Council

2.14 Complementing the above support measures, the Hong Kong Productivity Council (HKPC) promotes productivity excellence through the provision of integrated support across the value chain of Hong Kong firms to enhance the value-added content of products and services and to increase international competitiveness.

2.15 Pursuant to the consultancy study on its role, management and operation completed in February 2002, the HKPC has re-positioned its service focus to provide integrated support to innovative and growth oriented Hong Kong firms across the value chain. Its principal sectoral focus is on manufacturing, particularly in Hong Kong's foundation industries, and related service activities. The main geographical focus is Hong Kong and the Pearl River Delta region (PRD).

(g) Hong Kong Design Centre

2.16 Design is an integral part of our innovative capability. We aim at promoting design and innovation for enhancing industry understanding and application of design and innovation, and as a value-added activity which could be integrated into mainstream business processes.

2.17 The Government has coordinated support and resources for the setting up of the Hong Kong Design Centre (HKDC), which is a multi-disciplinary centre to promote design as a value-added activity, to enhance design standards, to foster design-related education, and to raise the profile of Hong Kong as an innovation and creative hub.

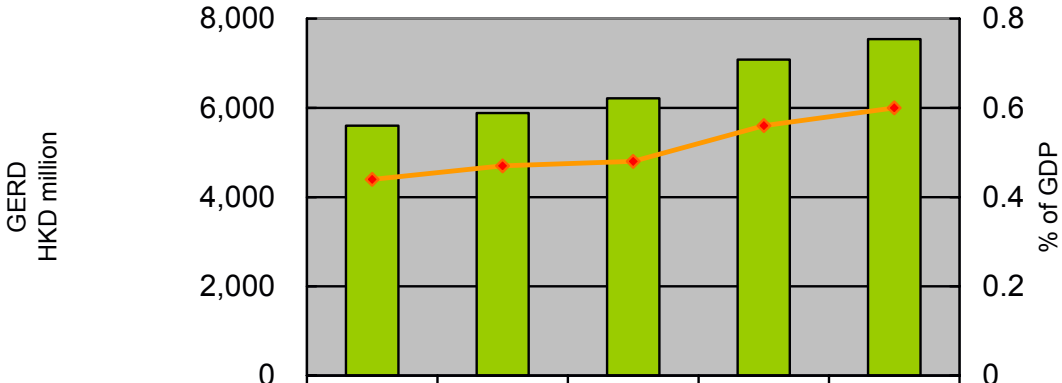
Where do we stand

2.18 Through our efforts in promoting innovation and technology over the past years, we have witnessed the strengthening of the R&D base in Hong Kong.

R&D expenditure and personnel

2.19 From the input side, there has been a growth in R&D expenditure in Hong Kong. The gross expenditure on R&D (GERD) in 2002 amounted to $7.5 billion, with the higher education sector accounting for 64%, followed by the business sector 33% and the government sector 3%. The GERD as a percentage of GDP has increased from 0.44% in 1998 to 0.6% in 2002 (Figure 2.3). Compared with 1998, the total number of R&D personnel (in terms of full-time equivalent) in 2002 increased by 43% to 12 890. Most of them were engaged in the higher education and business sectors, which accounted for 62% and 35% of the total in 2002 respectively[9].

Figure 2.3 R&D expenditure as a percentage of GDP in Hong Kong



	1998	1999	2000	2001	2002
HKD million	5,602.5	5,885.4	6,218.4	7,087.3	7,543.6
% of GDP	0.44	0.47	0.48	0.56	0.60

Source : Census and Statistics Department, HKSAR Government

R&D output

2.20 From the output side, an important indicator is the amount of new knowledge generated through R&D and its further promotion and application. In 2001/02, the total number of items of research output by the eight higher education institutions funded through the University Grant Council (UGC) stood at 26 996, representing a notable increase of 69% over 1995/96 (Table 2.1).

[9] Census and Statistics Department, HKSAR Government

Table 2.1 Research Outputs of University Grants Committee-funded Higher Education Institutions [a]

Year	1995/96	1996/97 [b]	1997/98	1998/99	1999/00	2000/01	2001/02
Number of Research Outputs	15,973	18,575	21,589	20,886	23,091	26, 680	26,996

Note: a - The figures covered only the 8 higher education institutions funded through the UGC.
b - The Hong Kong Institute of Education came under the aegis of the UGC with effect from 1 July 1996.

Source: Census and Statistics Department, HKSAR Government

Patents

2.21 Further down the R&D value chain, the number of patents generated indicates the innovation capability of an economy. There has been a growing trend for the United States, being one of the major markets of Hong Kong, granting patents originated from Hong Kong (Table 2.2).

Table 2.2 Patents Granted by USPTO

Year	1999	2000	2001	2002	2003
Patents originated from Hong Kong	395	540	603	546	667

Source data from US Patent & Trademark Office (USPTO), Fiscal Year Statistics (October 1 through September 30). Patents granted by USPTO include utility, design, plant, and reissue patents.

Impact of ITF

2.22 The Government has recently engaged a survey firm to conduct an independent survey and collect information from ITF fund recipients. From the responses received, as a very broad indicator, each ITF project has on average generated 1.3 technologies or products, and 0.55 patent has been filed per project

and 0.15 patent has already been granted per project. The survey also gathered feedback from industrial users or potential users of the ITF project deliverables on whether the ITF has facilitated innovation and technology development in Hong Kong. Among those who have responded to the survey, 71% and 64% of them agreed that the ITF could help upgrade the technology level of Hong Kong industries and contribute to the development of a knowledge-based society in Hong Kong respectively.

Box 2.2 Survey on Innovation and Technology Fund

- The survey was conducted from 8 December 2003 to 27 January 2004 by means of self-administration of structured questionnaires designed to collect opinions from various stakeholder groups. A total of 1,071 valid questionnaires were collected. Below is a summary of the findings on the following aspects -

  (a) private sector contribution in R&D;

  (b) human capital deployment, such as number of researchers involved, number of researchers trained and employed;

  (c) number of patents/copyrights filed or registered; and

  (d) technologies, products and services developed.

- The 232 ITSP projects surveyed altogether generated 335 technologies or products, and a total of 124 patents have been filed and 41 patents have already been granted. These projects have employed a total of 714 research staff;

- The 90 UICP projects surveyed altogether generated 78 technologies or products, and a total of 47 patents have been filed and 10 patents have already been granted. The universities participated in these projects have employed a total of 235 research staff; and

- The 86 SERAP projects surveyed altogether generated 122 technologies or products, and a total of 53 patents have been filed and 11 patents have already been granted.

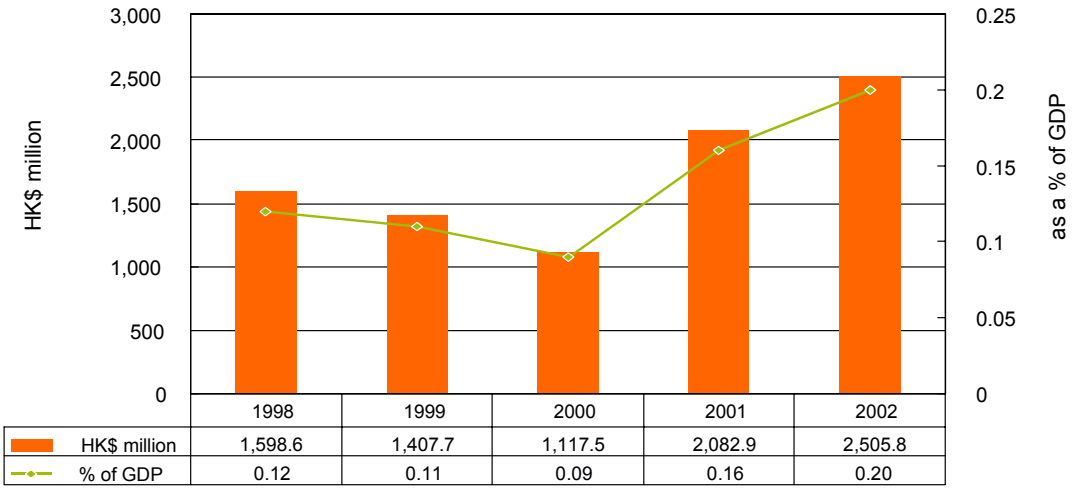
- Overall speaking, among those industrial users or potential users of ITF project deliverables who have responded to the survey, 71% and 64% of them agreed that the ITF could help upgrade the technology level of Hong Kong industries and contribute to the development of a knowledge-based society in Hong Kong respectively. In addition, 74% and 70% of them agreed that the ITF could foster the development of the research culture among the local enterprises and help the growth and development of technology start-ups in Hong Kong respectively. 62% of them agreed that the ITF could contribute to the creation of more technology-related job opportunities in Hong Kong.

Growing Importance of R&D and Technological Innovation

2.23 Hong Kong's strategic location in PRD has served us well over the last few decades for building up a manufacturing base in the hinterland. Many Hong Kong industrialists have set up production facilities in the PRD, taking advantage of the low production costs in the Mainland[10]. However, with the changing global market and competition from other low cost economies, the Hong Kong industries can no longer rely solely on price competitiveness.

2.24 The need to expand our R&D activities and to upgrade our innovative capability is also recognised by the private sector and reflected in a number of recent surveys. It is estimated that about 1 223 establishments have undertaken R&D activities in 2002, signifying a pronounced increase of 38% as compared with the corresponding figure of 887 establishments in 2001[11]. Measured in terms of investment in R&D, total expenditure on in-house R&D activities in the business sector amounted to $2 506 million in 2002. The ratio of business expenditure on R&D (BERD) to GDP increased markedly from 0.12% in 1998 to 0.2% in 2002 (Figure 2.4).

Figure 2.4 Business Expenditure on R&D in Hong Kong, 1998-2002



	1998	1999	2000	2001	2002
HK$ million	1,598.6	1,407.7	1,117.5	2,082.9	2,505.8
% of GDP	0.12	0.11	0.09	0.16	0.20

Source: Hong Kong Monthly Digest of Statistics May 2004, Census and Statistics Department, HKSAR, PRC

[10] Tsang and Cheng "The Economic Link-up of Guangdong and Hong Kong: Structural and Developmental Problems" in Chai J.C.H., Y.Y. Kueh and C.A Tisdell, "China and the Asia Pacific Economy", Nova Science Publishers, New York, USA, 1997.

[11] Report on 2002 Annual Survey of Innovation Activities in the Business Sector. Census and Statistics Department, HKSAR Government.

2.25 According to the survey report *Made in PRD – The Changing Face of Hong Kong Manufacturers* [12], there were 63 000 Hong Kong based manufacturers / importers-exporters economically active in the Mainland in 2001, representing 52% of all registered manufacturers and importers-exporters in Hong Kong. Around 67% of the companies surveyed (number of companies surveyed: 481) conducted R&D in Hong Kong. Amongst the companies with operations in Guangdong, 78% have plans to undertake R&D activities in the future. Amongst the companies currently engaging in R&D activities, some 56% have plans to increase R&D expenditure.

2.26 In 2002, the value of exports for high technology products was $21 billion[13]. Between 1992 and 2002, the ratio of the value of domestic exports of high technology to GDP ranged from 0.02 to 0.05. It accounted for 16% to 22% of the total domestic exports for the same period. With the implementation of the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA) bringing zero import tariff, coupled with the adoption of the 30% value-added criteria as CEPA origin rule for some product codes, it is envisaged that the manufacturing of products with high value-added content or substantial intellectual property (IP) input would increase.

Looking Ahead

2.27 Our emerging strength in R&D, the progress of the technological infrastructural development and also the growing awareness of the importance of innovation and technology made ready a platform for Hong Kong to advance further in its innovation and technology development. Looking ahead, we will build on this platform and harness the potential and opportunities for further innovation and technology development. We will also address the following areas -

Bottom-up approach

2.28 The existing innovation and technology programme has largely been implemented on a bottom-up approach. As a result, the direction and focus of applied R&D were diffused and fragmented. Since late 2000, the ITF has started a solicitation programme to invite project proposals according to specified themes such as electronic commerce using the Internet, nanotechnology and

[12] The report was conducted by the Hong Kong Centre for Economic Research, commissioned by the Federation of Hong Kong Industries and supported by the ITF.

[13] Hong Kong Monthly Digest of Statistics, May 2003, Census and Statistics Department, HKSAR Government.

media technologies for digital entertainment, etc. The Government has also been promoting certain technology areas, such as IC design, information technology and biotechnology, in conjunction with the ASTRI and the HKSTPC. However, the R&D projects were initiated by individual researchers who have been operating independently. The bottom-up approach is not very conducive to close collaboration among the various research institutions and creating synergies to form a bigger impact.

Private sector participation

2.29 Private sector participation in R&D activities is important to innovation and technology. It is encouraging to note the recent pronounced increase in the number of establishments involving in R&D activities and the amount of investment. We should continue to provide a conducive environment to facilitate the private sector to take part in R&D activities and make use of the results. However, under the existing funding mechanism, most ITF projects are completed within two to three years and the researchers concerned usually may have other engagements after the completion of the projects that would precluded them from providing ongoing support to industry to commercialize the R&D deliverables. Without longer-term support from researchers, the industry would have little incentive to be involved in R&D projects.

CHAPTER THREE

New Strategy of Innovation and Technology Development

Objective

3.1 Having considered the current state of innovation and technology development in Hong Kong and the issues and challenges before us, the Government proposes a new strategic framework to enable the sustainable development of our innovation and technology programme in enhancing the competitiveness of the industry.

The Strategy

3.2 The new strategy of innovation and technology development emphasizes on the following five elements -

(a) Focus - to identify key technology focus areas where we have competitive advantages for optimal use of resources to create greater impact;

(b) Market relevance - to adopt a demand-led, market-driven approach in driving the innovation and technology programme to ensure that our investments are relevant to industry and market needs;

(c) Industry participation - to closely involve the industry in defining the focus areas and in other stages of innovation and technology development;

(d) Leverage on the Mainland - to capitalize on the opportunities presented by CEPA and to utilize the production base in the Greater PRD as the platform for developing our applied R&D and commercialization of applied R&D deliverables; and

(e) Better coordination - to strengthen coordination among various technology related institutions and the industry for enhanced synergy and impact.

Steering Committee on Innovation and Technology

3.3 To coordinate the formulation and implementation of innovation and technology policy, and ensure greater synergy among different elements of the innovation and technology programme, the Government established the Steering Committee on Innovation and Technology in January 2004, which is chaired by the Secretary for Commerce, Industry and Technology and comprises representatives from technology infrastructure, universities and industry. The terms of reference and membership of the Steering Committee are set out at Annex A. The Steering Committee has endorsed the new strategy for further development and implementation.

Focus Areas

3.4 To implement the strategy, priority is given to the identification of technology focus areas as we recognise that our R&D base is not as sizeable as some other economies. This naturally requires us not to spread available resources too thinly over too many areas. Through our regular contacts with universities, technology related institutions and industry over the years and our experience in administering the ITF, we recognise that Hong Kong has more comparative advantages in certain technology areas than others. We also note that some technology areas would match the needs and add more value to our industry while others may take more time down the road to become mature technology for application. To address the situation, we need to leverage on technology focus areas where we have strengths and have the potential for meeting market needs.

3.5 We believe that business decisions are best made by businesses. However, in technology development, particularly in the case of Hong Kong where most industry players are small and medium-sized enterprises, the Government, together with the technology support organizations, can play a more active role in bridging the gap between research capabilities and technology needs. A detailed account of how the Government identified the proposed focus areas is given in Chapter 4.

New Funding Approach

3.6 To ensure that applied R&D efforts will be driven towards the focus areas in future, the ITF will adopt a new funding approach. Instead of funding small, diversified projects, ITF resources will mainly be used in supporting the establishment and development of R&D Centres on particular focus areas. Other projects falling outside the focus areas will still be considered but will only be funded on projects that can demonstrate exceptional merits. Moreover, the ARF will also make closer reference to the focus areas for future investments for better synergy.

3.7 Our technology infrastructure could support applied R&D efforts in the focus areas through the provision of physical infrastructure for hosting the R&D Centres, and offering technology transfer services and promotion. An R&D Centre would be responsible for developing core competencies in applied R&D in a particular focus area and facilitating technology transfer to the relevant industries. With institutional and financial support, it is expected that the R&D Centres would form clusters and become focal points for participation of different stakeholders in the innovation system, and even attract collaboration opportunities from Mainland and overseas. Detailed proposal on the mode of operation of the R&D Centres is provided in Chapter 5.

Innovation System

3.8 Under the new strategic framework, it is hoped that various elements of the innovation and technology programme could work closely together to generate greater impact along the R&D value chain from basic research to commercialization and production. Figure 3.1 and Figure 3.2 below illustrate the innovation system and the proposed roadmap under the new strategy.

Figure 3.1 Innovation System under the New Strategy

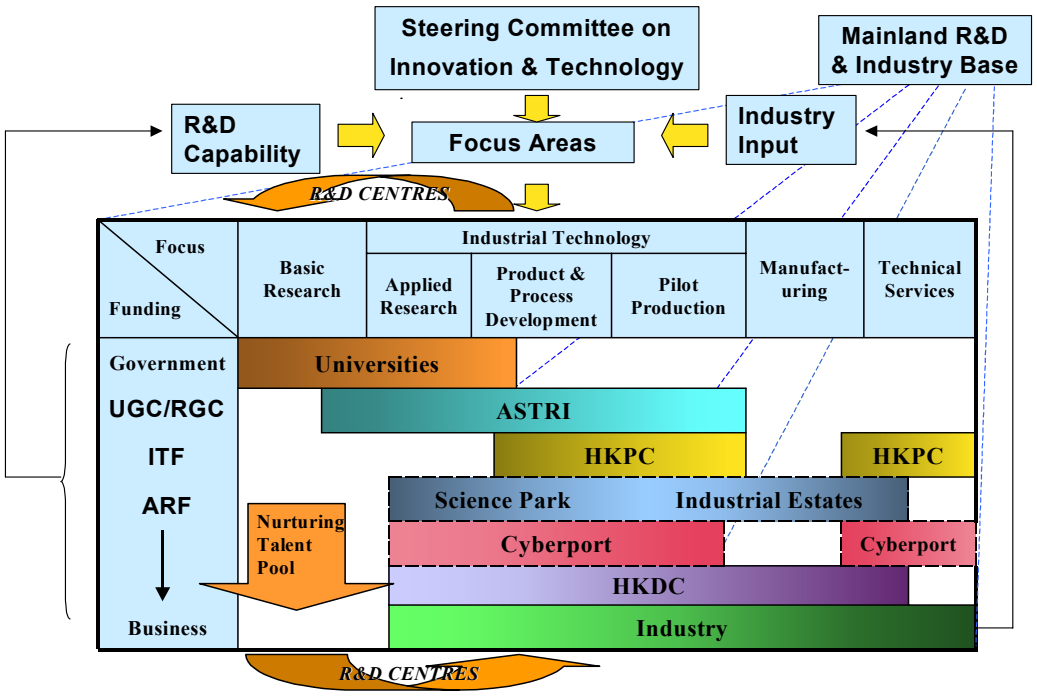
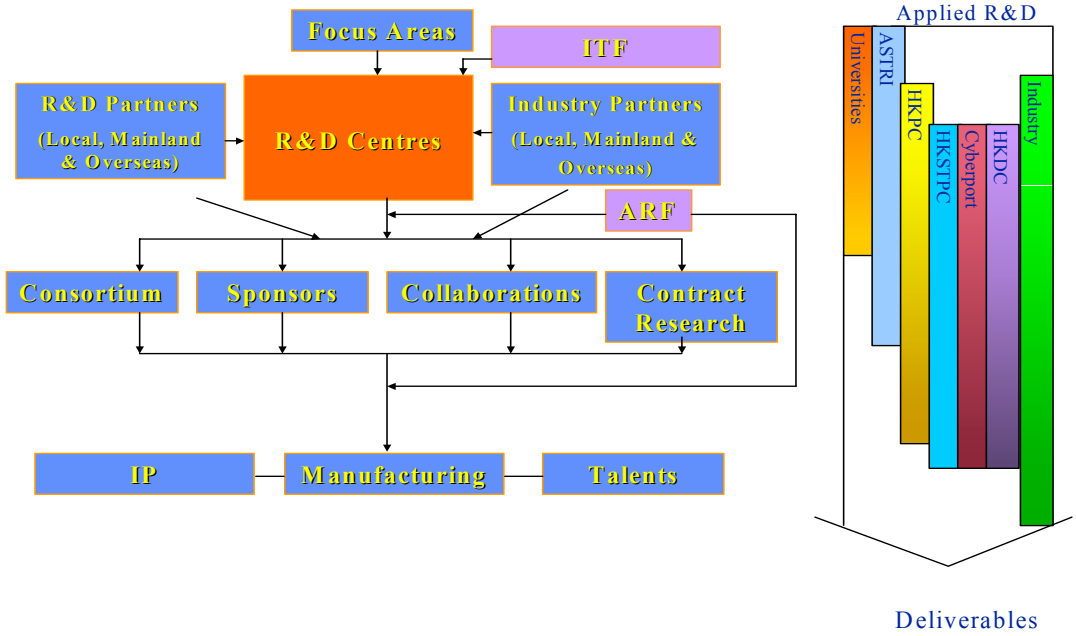


Figure 3.2 Technology Roadmap under New Strategy



CHAPTER FOUR

Technology Focus Areas

Identification of Focus Areas

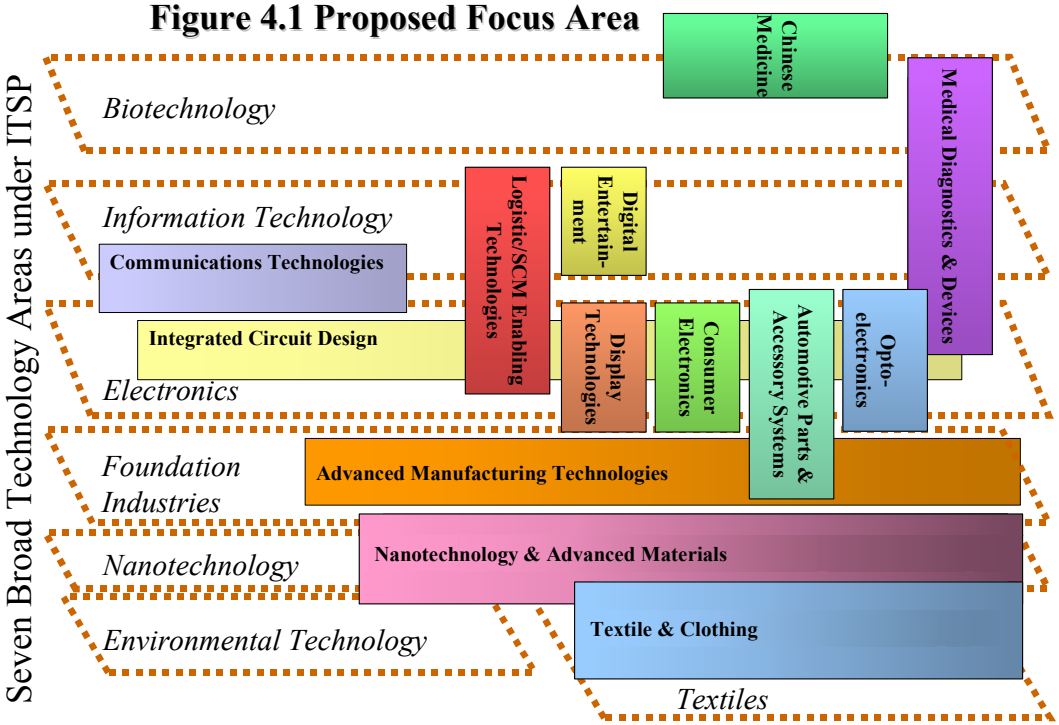
4.1 The new strategy emphasizes on a market-driven, demand-led approach. With this approach, we have been trying to identify technology areas where Hong Kong has competitive edges (e.g. research strengths, strong industry base) and has the potential for meeting market needs (e.g. demand for new products, new or emerging technologies or technology upgrading). In the past six months, we have visited various universities and technology related institutions and discussed with them the latest technology development trend and progress of their research programmes. We have also conducted a series of roundtables, company visits and consultative meetings to seek industry's views on their technology needs and potential focus areas for future development. After our preliminary consultation, we have identified the following 13 proposed focus areas -

(a) Advanced Manufacturing Technologies
(b) Automotive Parts and Accessory Systems
(c) Chinese Medicine
(d) Communications Technologies
(e) Consumer Electronics
(f) Digital Entertainment
(g) Display Technologies
(h) Integrated Circuit Design
(i) Logistics/Supply Chain Management Enabling Technologies
(j) Medical Diagnostics and Devices
(k) Nanotechnology and Advanced Materials
(l) Opto-electronics
(m) Textile and Clothing

4.2 Some of the above focus areas are industry-based, while some are related to specific technologies or applications. At present, the Innovation and Technology Support Programme of the ITF are divided into seven broad technology areas, i.e. biotechnology, electronics technology, environmental technology, foundation industries, information technology, nanotechnology and textile technology. With the new objective to identify a sharper focus for future technology development, efforts have been made to delineate demand-led

vertical application areas or coherent horizontal technology segments among ITF's existing programme areas as proposed focus areas. Given the multi-disciplinary nature of modern technologies, it is impossible to find simple classification of the closely intertwined areas into separate, self-contained categories. Figure 4.1 below shows some of the intricate relations among the proposed focus areas. It should be noted that the proposed focus areas mainly serve as the starting point for consultation. The final definition or scope of the focus areas would depend on many factors, such as market potential, commitment of industry partners and expertise of the researchers.

Figure 4.1 Proposed Focus Area



4.3 Apart from the above proposed focus areas, design is also considered as a core element in the innovative process, in particular, in facilitating industries to move up the value chain by switching the production mode from original equipment manufacturing (OEM) to original design manufacturing (ODM) and thence original brand manufacturing (OBM). Given the diversity of design disciplines and the multi-disciplinary nature of design processes, the Government considers that the promotion of design should be put under a separate initiative. The Financial Secretary announced in his Budget Speech on 10 March 2004 that the Government planned to launch a "DesignSmart" initiative with the creation of a $250 million fund, which was

subsequently approved by the Legislative Council Finance Committee on 11 June 2004. The Government will take forward the initiative along the proposed new strategy with a view to supporting and promoting design and related activities that would offer businesses the ability to differentiate themselves from their competitors, add value to their products or services and increase their economic competitiveness.

Proposed Focus Areas

4.4 Brief descriptions of the 13 proposed focus areas are set out in paragraphs 4.5 – 4.44 below. More details about the background and development trends of the technology areas and the relevant industries, Hong Kong's strengths and weaknesses in these proposed focus areas and potential R&D topics in each area are set out at Annex B.

(a) Advanced Manufacturing Technologies

4.5 Advanced manufacturing technologies (AMTs) refer to the integration of product, process and system development through the synergetic combination of fundamental and applied engineering knowledge in solving complex manufacturing problems. AMTs cover techniques and processes of materials forming, machining, surface finishing, fabrication and assembling of critical parts and components. They are key enablers to help manufacturers in enhancing productivity, improving quality and reducing cost.

4.6 AMTs are applied in a wide range of sectors of Hong Kong's foundation industries, including household electrical appliances, jewellery, watches and clocks, toys, machinery, metal parts, optical parts and components. The ITF has supported more than 30 AMT related projects with funding of over $100 million. The HKPC and local universities have successfully completed many R&D projects and disseminated the technologies to the industry.

4.7 In the increasingly globalized economy, local manufacturers are facing severe competition from their overseas counterparts. They require new AMTs to enhance their competitiveness and help them explore and develop emerging and niche markets. In the preliminary consultation process, the local manufacturing industry was generally supportive of the establishment of an R&D Centre in AMTs. Representatives of related trade associations shared the view that Hong Kong manufacturers should develop their own brand name products, high value-added processes and products of high technology content. In particular, the watches and clocks industry expressed strong wishes to develop good quality mechanical watch movements. Apart from watch movement, other

potential R&D topics include manufacturing of optical components, and technologies relating to the processing, finishing, and recycling of magnesium alloy.

(b) Automotive Parts and Accessory Systems

4.8 Given the growing affluence of the Chinese people, the domestic demand and production of automobiles in the Mainland have increased significantly in the past decade. Many foreign automobile companies have formed joint ventures and set up assembly lines in the Mainland. Looking ahead, automotive is expected to be a fast-growing industry in the Mainland. It is a key industry sector supported under the national policy. In particular, the Guangdong Province has named the automotive industry as one of its pillar industries. At present, most of the high value-added critical components are imported from overseas for assembly in the Mainland. Many smaller scale car manufacturers in the Mainland are lagging behind the international standards in terms of technology, design and product quality. There is a good opportunity for Hong Kong to provide the necessary technologies and components to support the development of the automotive industry in the Mainland.

4.9 Automotive parts manufacturing involves over 50 different industry sectors, ranging from those more related to foundation industries such as manufacturing of plastic internal trims to high value-added sectors such as electronics and photonics. Hong Kong has a strong base of foundation industries including metals/plastics processing, surface finishing and electronics, which could form the backbone for the manufacturing of automotive parts and components. Many local manufacturers have already been engaging or are developing business in this growing industry.

4.10 In our preliminary consultation process, the trade associations concerned supported the proposal of making "Automotive Parts and Accessory Systems" a focus area and the establishment of an R&D Centre in this area. Potential R&D topics include development and manufacturing of lighting and electrical components, infotainment systems, control and informatics, critical parts and accessories, as well as technologies relating to advanced materials and processing, and testing and validation of automotive parts and accessory systems.

(c) Chinese Medicine

4.11 Owing to its demonstrated efficacy, natural origin and fewer side effects, Chinese Medicine (CM) has become increasingly accepted as a kind of alternative medicine and a source for health supplement. With a long history of

practising CM and unique relationship with the Mainland which possesses the largest pool of CM resources, Hong Kong could become a world centre for the development of health food and pharmaceuticals based on CM.

4.12 To attain this vision, a CM regulatory framework, gradual integration of CM into mainstream medicine, training of CM expertise, as well as investment on CM R&D and infrastructure, including the Hong Kong Jockey Club Institute of Chinese Medicine (HKJCICM), have been put in place. CM research is currently one of the most pursued R&D activities among local universities. With effect from 2004, CM products enjoy tariff-free access to the Mainland under CEPA. Given the reputation for quality and reliability of CM products produced in Hong Kong, Hong Kong CM companies are well positioned to compete for a bigger market share in the Mainland and worldwide CM market.

4.13 There is a consensus from both the local CM industry and academia that collaboration between the industry and universities should be strengthened and that research topics should be better coordinated and aligned with market needs. It has been suggested that a virtual centre, instead of a physical centre, or consortium with a neutral standing be established to coordinate activities for addressing the needs of the industry. The virtual centre/consortium should leverage on the existing resources and expertise in local universities and focus on providing technical support and service to the industry, which are currently not covered by the HKJCICM.

(d) Communications Technologies

4.14 Communications technologies address the issue of how signals can be transmitted and properly received over a noisy channel. They can range from simple point-to-point voice communication to multi-party, multi-channel and multi-media applications. Examples of communications technology platforms include cellular systems, wireless LANs and wireless personal area networks.

4.15 Over the years, Hong Kong has built up substantial competitive edge in its telecommunication sector given its sophisticated telecommunication infrastructure, open and competitive operating environment, deep technology diffusion in the community and its position as the global test-bed of new technologies. There is also a local industry presence with companies that produce advanced telecommunications products. According to the Hong Kong Trade Development Council, Hong Kong was the second largest world exporter of telephone sets in 2001. There were 45 manufacturing firms and 873 trading firms related to the telecommunication equipment sector as of 2002. The Mainland is also witnessing rapid developments in the area and has become one

of the fastest growing telecommunication markets in the world. Indeed, the mobile terminal production in the Mainland is surging forward and many large-sized companies, such as ZTE and Huawei, have been engaging in the design and manufacturing of high-end telecommunications equipment.

4.16 Hong Kong has a strong base of expertise in this technology area. Local universities and the ASTRI have the capabilities to develop technologies with commercialization potential within their spheres of excellence, and to transfer technologies through training, licensing and turn-key projects to meet the market needs of Hong Kong and neighbouring regions. In our preliminary consultation process, the local communications industry has shown interest in establishing an R&D Centre in this area. Potential topics include development of handset component technologies, development of wireless application platforms, and setting up test-beds to support developers and operators.

(e) Consumer Electronics

4.17 Hong Kong has long been known for its strong position in the global market of calculators, radios, telephone sets, audio-visual (AV) products, as well as parts and components such as printed circuit boards (PCB) and liquid crystal displays (LCD). The electronics industry is the largest export earner of Hong Kong. Hong Kong's electronics exports, the majority of which are consumer electronics products, increased by 20% over the previous year to $732 billion in 2003, accounting for 42% of Hong Kong's total exports.[14]

4.18 Consumer electronics products are in general characterized by very short product cycle due in part to the continuous changing consumer tastes and the fast development of electronics and information technology. Hong Kong manufacturers have been well known for their adaptability and responsiveness to these changes. This has been, and will be, a key component for the success of Hong Kong's electronics industry. Hong Kong has many other favourable, well-established conditions, such as proximity to an effective manufacturing base in the Mainland, and a very efficient infrastructure for telecommunications, transportation, information flow, market capitalization and protection of IP rights. Furthermore, the implementation of CEPA and the emergence of national standards for electronics products, such as the AVS, WAPI and TD-SCDMA, etc., will also place Hong Kong manufacturers in a better position to compete in the Mainland market than their overseas counterparts.

4.19 By the scale of the industry, the economic benefits to Hong Kong

[14] Hong Kong Trade Development Council.

can be very significant if ITF resources can be deployed to increase the competitiveness of Hong Kong's electronics industry. In the preliminary consultation process, the industry supported the proposal of forming an R&D Centre in consumer electronics. Digital AV products have been proposed as the key topic for the focus area. Other potential topics include health-care products and educational products.

(f) Digital Entertainment

4.20 Digital entertainment refers to films, videos, television programmes, animation, edu-tainment software and games that involve the use of digital technologies, such as computer graphics and interactive techniques, in their production. The digital entertainment industry is a new and vibrant industry, cutting across various service and production sectors.

4.21 The local digital entertainment industry has grown considerably over the past few years. There are currently about 350 local companies engaging in the development of interactive entertainment and multimedia software, in particular games. In addition to the local market, the huge Mainland market presents enormous opportunities for local game developers. Due to the attraction of huge market potentials, competition is keen and comes from all over the world, in particular Korea and Japan. The local digital entertainment industry requires appropriate technologies and infrastructure support in order to maintain a competitive position in the region. There is a good opportunity for the local industry to develop games initially for the Hong Kong market and then tap on the Mainland market to expand.

4.22 Hong Kong is known as a city full of innovative ideas for content development. In fact, it is one of the regional leaders in creative industries, such as film-making and advertisement production. Moreover, Hong Kong has a strong base of research in digital entertainment technology in the local institutions, including the universities and other technology support organizations. In the preliminary consultation process, the local digital entertainment industry expressed the need for technology support to further strengthen their capability in game development. Representatives from related industry sectors shared the views that local companies could leverage on the technologies made available from an R&D Centre to develop more sophisticated game products with advanced features. Some project topics, such as infrastructure for game development, enabling technologies for game engines, and enabling technologies for game servers are considered important for the future development of the local digital entertainment industry.

(g) Display Technologies

4.23 Display technologies refer to technologies in developing flat panels such as LCD, plasma display, micro-display and organic light-emitting diode (OLED). Flat panel displays are high-value, critical components for telecommunications and electronics consumer products that are in high demand. It is one of the key technologies being actively pursued by most industrialized countries.

4.24 Over the years, Hong Kong has developed a strong manufacturing base in display industry. With the growing demand in various kinds of electronics products globally, the market potential for electronics displays is huge. At the same time, local display manufacturers are facing keen competition, in particular from strong players in Taiwan, Korea and Japan. It is therefore vital to help local manufacturers develop and master appropriate display technologies to upgrade their capability in display product development. In response to the global trend and market opportunities, Hong Kong could leverage on its LCD production experience to develop OLED displays. It is envisaged that OLED has a great market potential and there is no clearly dominant player in the area so far.

4.25 Hong Kong has strong R&D strength in display technologies and has established infrastructure support in relevant areas through universities, research institutions and technology support organizations. Many local display manufacturers have also invested in the R&D of different types of display technologies. In the preliminary consultation process, several major display companies indicated support for the establishment of an R&D Centre for the development of display technologies. Representatives from related industry sectors shared the views that Hong Kong should develop flat panel displays and leverage on its existing R&D strength and resources. It was suggested that OLED technology should be a key topic of the proposed R&D Centre.

(h) Integrated Circuit Design

4.26 For most electronics products nowadays, key product functions are designed into the IC chips. ICs are the core technology of these electronics products, and therefore IC design is the most important portion of the value chain of electronics manufacturing.

4.27 As mentioned in paragraph 4.17 above, the electronics industry is the largest export earner of Hong Kong. There is a large and increasing demand of IC chips by Hong Kong manufacturers. However, most local manufacturers

are still sourcing their critical IC components from overseas suppliers, despite the fact that Hong Kong already has a significant IC design industry. Consequently, their abilities in product innovation and in raising the profit margin have been restricted. Similar situation applies to many Mainland enterprises.

4.28 The Mainland has well recognized the strategic importance of the semi-conductor industry to the country, and has named IC design as one of the key industries under the Five Year Plan. Likewise, Hong Kong has funded through the ITF a number of projects for R&D on some special ICs and for building up the infrastructure for IC design and development in the Science Park to support the industry.

4.29 The implementation of CEPA and easy access to national electronics standards, such as AVS and WAPI, give Hong Kong's IC designers the competitive edge in the Mainland market. Our robust IP protection regime is also a favourable factor for the development of the IC design industry in Hong Kong. There are good opportunities for the local IC design industry in the Mainland and global markets. To ensure better synergy and optimization of resources, programmes under the proposed R&D Centre for IC design should be coordinated with programmes of other R&D centres in areas such as communications technologies, consumer electronics and logistics/supply chain management enabling technologies.

(i) Logistics/Supply Chain Management Enabling Technologies

4.30 Logistics/supply chain management (SCM) enabling technologies cover a wide spectrum of technologies that facilitate the smooth flow of goods, services and related information as well as the integration of business processes across the supply chain. In particular, the emerging Radio Frequency Identification (RFID) technology could revolutionize the product information flow and has a high potential to transform the whole global supply chain into a highly effective and efficient information pipeline, especially when coupled with a global information network, such as the EPCglobal Network.

4.31 Hong Kong is a major logistics hub that possesses a world-class transport infrastructure and excellent information connectivity. Transportation and logistics related sectors (including freight and passenger transport) account for over 7% of our GDP, employing over 210 000 workers. Every day, over $2 600 million[15] worth of goods are produced by tens of thousands of factories scattered over the Mainland and shipped to Hong Kong for export. Such export

[15] Hong Kong Trade Development Council.

activities require quality logistics support to keep the supply chains intact and efficient. Hong Kong's logistics facilities and services have contributed significantly to the PRD's rapid rise as a production base. The PRD, in turn, has provided Hong Kong with a huge and expanding cargo base. Mainland China has become a major manufacturing base in the world, supplying a majority of commodity items to the world market. Hong Kong occupies a unique position as the gateway and logistics hub to link the Mainland with the world, especially after the implementation of CEPA. It is vital to develop and introduce appropriate technologies to support the growth of the logistics/SCM industry. In this regard, the benefits of developing RFID-based logistics are significant, as the new technology will greatly improve the visibility of products flowing along the supply chain. The development of RFID-based logistics is gaining momentum on international fronts, with many top worldwide retailers already initiated adoption of the technology in their operations. In fact, there is an increasing awareness on RFID technology in the local industry and some local companies are actively exploring its potential in their supply chain operations.

4.32 Hong Kong has a strong R&D and industry base in logistics/SCM. Many research groups in local universities are dedicated to research in logistics related IT system and methodology. In our preliminary consultation process, the local logistics community was supportive of establishing an R&D Centre in this area. The Centre could conduct pilot projects and facilitate local manufacturers in meeting the initiatives from global retailers in the short-term, provide infrastructure for fast access to RFID-based product information and conduct R&D on RFID in the mid-term, and enhance the overall efficiency of the supply chain operation in the long run.

(j) Medical Diagnostics and Devices

4.33 Medical diagnostics and devices (MDD) include the use of multi-disciplinary technologies to produce a broad range of devices, equipment and diagnostic tests for medical use. With the rising living standard and increasing demand for better healthcare, the market for MDD presents high growth opportunities in Hong Kong and worldwide.

4.34 Local universities possess state-of-the-art research facilities, and are internationally competitive in pursuing research in biotechnology. Through the integration of biomedical and engineering sciences, the coordination among various institutions would be strengthened and greater synergy and impact would be created in the local industry. Combining with Hong Kong's traditional strengths in information technology, IC design, electronics, etc., the technologies and products developed could become significant tools to address the soaring

worldwide demand for rapid and accurate diagnosis.

4.35 In the preliminary consultation process, both the local MDD industry and the relevant research groups supported the establishment of an R&D Centre in this area. It was suggested that the Centre could help further develop research ideas from universities for transfer to industry, and help in technology upgrading of the local industry.

(k) Nanotechnology and Advanced Materials

4.36 Nanotechnology and advanced materials form a broad and inter-disciplinary area of R&D that can enable new or improved properties in products and engineering processes. The essence of nanotechnology is to manipulate atoms and molecules at nanoscale level and create nanostructures with fundamentally new organizations and properties.

4.37 In recent years, a combination of government funding, corporate-academic collaborations and funding by venture capitalists have been providing support for pre-competitive R&D on nanotechnology in many countries due largely to its enormous potential economic benefits. Sharing the same vision, nanotechnology has been named as one of the key technology areas in Hong Kong since 2001. With the ITF's funding support, two nanotechnology centres have been established at local universities. Many local enterprises have also shown interests in exploiting nanotechnology and new materials in their new product development. Appropriate nanotechnology and advanced materials technologies could help local enterprises develop niche markets for new and high value-added commercial products. Some successful examples include nickel-free metal alloys for watch and jewellery, advanced encapsulates with low moisture and tailored modulus for electronic packaging, textiles treated with nanostructured materials and water repellent apparels with high air permeability, and air purification system that removes odour and kills bacteria by photocatalytic nano-coating.

4.38 Hong Kong has strong R&D and infrastructure support in nanotechnology and advanced materials, with many internationally renowned researchers in local universities. In the preliminary consultation process, the local industry generally supported programmes to develop nanotechnology and advanced materials technologies. Representatives from various industry sectors shared the views that Hong Kong should leverage on its existing R&D strength and resources and develop nanotechnology and advanced materials-based commercial products. They suggested that nanotechnology and advanced materials technologies could help develop a wide variety of novel and high

value-added products with great market potential.

(l) Opto-electronics

4.39 Opto-electronics is an enabling technology platform for a wide range of applications in areas such as communications networks, industrial equipment and lighting.

4.40 Hong Kong has long established a strong industrial infrastructure in electronics and precision engineering, which can provide support to opto-electronics, and the PRD region is host to many opto-electronics companies. The strong manufacturing base and fast-growing economy in the Mainland present opportunities for new applications to be developed. Opto-electronics based systems are expected to be deployed in home networks and automobiles. Recent focus for the communications market is concentrated on datacom and other short-distance applications. The trend is to bring opto-electronics enabled systems into consumers' daily lives. High brightness light-emitting diodes (LED) are beginning to serve as light sources for indoor and outdoor lighting. Opto-electronics sensors are being used for industrial applications such as monitoring of building structures. Most of these applications can benefit from disruptive technologies that offer great market potential. They provide a rare opportunity for local companies to leap-frog onto a higher technology level that is better suited for global competition.

4.41 Hong Kong has a strong research base in opto-electronics, with many research groups in local universities dedicated to R&D in this area. The ASTRI has established photonics as a key strategic area and it has achieved commercial success from a recent spin-off of part of its photonics research team. The HKSTPC has also identified opto-electronics as a focus area. In the preliminary consultation process, the local opto-electronics community welcomed the establishment of an opto-electronics R&D Centre. Proposed R&D topics include short distance optical network, solid state lighting, industrial opto-electronics applications and packaging techniques.

(m) Textile and Clothing

4.42 Textile and clothing technologies cover various production and development processes on textile fibres, yarns, fabrics, as well as advanced manufacturing and design techniques on garments. They are key enabling technologies to help manufacturers upgrade and improve their capability, produce innovative products, and enhance production processes and support services.

4.43 Textile and clothing is one of the major manufacturing sectors in Hong Kong, employing a total of 45 816 workers in 2003. The industry had a gross output of $52.7 billion in 2001[16]. With the increasingly globalized economy and the complete removal of quotas by 2005 under the WTO Agreement, the industry is facing enormous changes. To remain competitive, the local textile and clothing industry needs to build on its strong foundation and adopts new and innovative technologies to excel in high value-added manufacturing.

4.44 Hong Kong has a strong R&D base in textile and clothing technologies. Local universities and technology support organizations have successfully completed many R&D projects that have brought enormous benefits to the local industry. Some recent examples are the development of nano-materials and related processing technologies, manufacturing of torque-free single cotton yarn, research on moisture management fabrics and development of shape memory garment. In the preliminary consultation process, the local textile and clothing industry supported the establishment of an R&D Centre. Potential R&D topics include technologies on materials development, fabric production, dyeing and finishing processes and garment design.

Selection of Focus Areas

4.45 The market potential, commitment of industry partners and expertise of the researchers in each of the 13 proposed technology focus area differ. Two of the major considerations in selecting the focus areas would be the degree of support and participation of industry and the commitment of research institutions for establishing an R&D Centre in a particular focus area.

4.46 The selection of focus areas would be an on-going process. As the first step, when considering whether a technology area should be named as a focus area, the Government would take into account the feedback from stakeholders during the consultation, the research strengths, the technology needs in the market, the potential contribution to the economy of Hong Kong, as well as the industry's commitment towards the development of that particular focus area. The Government envisages that some of the technology focus areas that could demonstrate better potential for development and are able to align support from the research community and the industry for establishing R&D Centres could be given priority.

[16] Census and Statistics Department, HKSAR Government; Hong Kong Trade Development Council.

CHAPTER FIVE

Research and Development Centres

Purpose

5.1 The establishment of R&D Centres is to provide a focal point for conducting applied R&D in specific focus areas for –

(a) immediate application in the relevant industries in order to enhance the competitiveness of our industries; and

(b) longer-term technology development of the relevant industries in order to help transform Hong Kong's industries into high technology and high value-added industries.

Role and Functions

5.2 For a specific focus area, the R&D Centre will –

(a) identify technology gaps and define the substantive R&D problems facing the industries;

(b) bring together researchers in the field to conduct R&D and offer technology solutions to the industries;

(c) develop core competencies in the specific focus area and help train researchers for on-going support for the development of the industries;

(d) help identify and liaise with other research groups within or outside the R&D Centre or Hong Kong that can provide input to the industries; and

(e) act as a focal point for information sharing on the latest technology and market development in the specific focus area.

Specific Tasks

5.3 Each R&D Centre would need to liaise with the relevant industries and develop a specific plan setting out the following –

(a) the technology roadmap for the relevant industries in the focus area; and

(b) the implementation plan, including the short-term R&D projects that would be conducted to meet the industries' needs as well as the groups of R&D projects to be conducted in the medium and long term.

5.4 In addition, each R&D Centre would need to undertake the following specific tasks -

(a) carry out the R&D projects and ensure that the projects are relevant to the industries;

(b) recruit and train R&D personnel for providing support to the relevant industries;

(c) manage the R&D projects to ensure timely completion and exercise stringent control over the use of resources;

(d) agree with the relevant industries on the detailed technology transfer and commercialization arrangements, including the sharing of IPs and royalties; and

(e) collect information and develop database on latest technology and market development relevant to the specific focus area for use by the industries.

Mode of Operation

5.5 Since the focus areas identified are quite diverse, it is not possible to specify a single model applicable to all R&D Centres developed for different focus areas. While the mode of operation of individual R&D Centres would depend on the actual proposals received, the following issues would need to be fully addressed in the proposal –

Host institution

5.6 There must be a host institution for the R&D Centre. It is expected that the host institution should possess the necessary basic R&D infrastructure so that the Centre could commence operation as soon as possible. The host institution can either be a university, ASTRI, HKPC, HKSTPC or Cyberport. The list is not exhaustive.

Relationship between the host institution and the R&D Centre

5.7 If the host institution is the ASTRI, the R&D Centre would form part of the ASTRI and be operated by the ASTRI under the existing management structure and model.

5.8 If the host institution is a research institution other than the ASTRI, the R&D Centre would be a separate legal identity from the host institution so that it could operate with maximum flexibility with its own management structure and operating model.

Staffing of the R&D Centre

5.9 The R&D Centre should be operated by full-time staff and be headed by a full-time Centre Director. Apart from managing and overseeing the operation of the Centre, the Centre Director is expected to champion the support of the industries and drive the development of R&D projects to support the industries.

5.10 The Centre should be supported by full-time R&D staff. If the R&D Centre is hosted by a university, university professors could be seconded to the Centre and released from most of the teaching and administrative duties in the host institution or other universities.

5.11 The Centre would have other R&D staff to undertake projects, such as research consultants, research fellows, research students and research associates. They could be full-time or part-time staff who only work for a defined period. They may come from other universities, not necessarily confined to the host institution. The R&D Centre would mainly consist of R&D staff and the host institution could provide support on the administrative and related matters.

Organization of R&D Centre

5.12 The Centre Director will be directly accountable to the Centre. The

host institution would need to work out the formal organizational structure of the R&D Centre. For R&D Centres hosted by institutions other than the ASTRI, they are expected to have their own Board of Directors to be appointed by the host institution. In addition, the R&D Centre should at least have the following set up –

(a) at policy level, a Steering Committee to steer the research direction and ensure that the Centre follows the agreed research direction, to monitor the performance of the Centre and review the need to maintain the Centre at regular intervals, say, every three years; and

(b) at project level, a Technical Advisory Committee to review and advise on the individual projects to be undertaken.

Funding for the R&D Centre

5.13 Funding for the R&D Centre would be provided at two levels by the ITF –

(a) funding for the initial years of the operation of the Centre. This would cover –

- the manpower costs of the core staff of the Centre, e.g. the Centre Director, the core R&D staff and some of the supporting staff;
- some of the equipment items required for initiating R&D projects; and
- other general operating costs.

(b) funding for individual projects undertaken by the Centre. This would cover the manpower, equipment and other direct costs of the R&D projects.

5.14 Relevant industry parties are also expected to provide funding mainly at individual project level and the level of funding to be provided would need to be worked out on a case-by-case basis.

5.15 The ITF would provide funding for the initial years of operation, say 3 to 5 years. Depending on the nature of the focus areas, some R&D Centres may become self-sustainable through income generated from the Centres' activities, such as conducting contract research for private enterprises and financial returns

from IP generated. As suggested in paragraph 5.12 above, the Steering Committee of each R&D Centre would review the need to maintain the Centre at regular intervals. Subject to the results of the review, the ITF may continue to support the Centre. On the other hand, some R&D Centres may have very specific tasks and hence a shorter life span. Once these specific tasks are completed, there should be a critical review on whether the Centre should continue to operate.

Industry Participation

5.16 The relevant industries may participate in the R&D Centre in the following ways –

(a) Consortium - companies interested in specific topics under a particular focus area can form a consortium and work under the R&D Centre. The consortium will work together with the R&D Centre to define the problems that need to be solved and to agree on the concrete project deliverables and delivery timetable. The consortium is expected to contribute a substantial part of the total project cost and negotiate the IP ownership with the Centre;

(b) Sponsor - when the R&D Centre initiates a research on platform technology or a particular project which could address some common problems of the industry, it would approach the industry to find sponsors and the latter will contribute part of the project cost. The Centre may work out separate IP arrangements with sponsors on a case-by-case basis;

(c) Collaborator – companies that aim to further develop a specific product, which requires R&D support by the R&D Centre, could collaborate with the Centre and the IP arrangement would be subject to negotiation. The companies concerned should at least contribute half of the total project cost; and

(d) Contract research - the R&D Centre could undertake consultancy service or contract research for specific companies. The companies concerned should bear the full cost of the project and own the IP generated, except separately agreed between the Centre and the companies.

Assessment of Applications for hosting R&D Centres

5.17 To facilitate the assessment of an application for hosting an R&D Centre, the applicant should set out the following in detail when a formal application is submitted –

(a) the vision and goals of the Centre;

(b) the entire roadmap of the technology development of the focus area, including the long, medium and short-term goals and projects to be achieved;

(c) an analysis of the challenges facing the industry and explanations on how the Centre could help the development of the project;

(d) the industry's commitment in the projects, such as contribution in cash and management and collaborative efforts;

(e) the commitment of the host institution towards the operation of the Centre;

(f) the total amount of funding required to operate the Centre for the initial years. The applicant should also set out clearly the staffing structure and cost estimates;

(g) the total amount of funding required for the initial projects to be carried out by the Centre and an estimate of the project funding required in the medium and longer term. As regards the initial projects, the applicant should spell out clearly the objectives, milestones, deliverables and benefits of these projects;

(h) the identification of the Centre Director and the detailed role of the Director in leading the Centre;

(i) details of the key personnel running the R&D Centre and their track record. Since the success or failure of the R&D Centre depends critically on the Director and his/her key team members, this is no doubt one of the most critical assessment criteria;

(j) the internal organization of the R&D Centre, including the management and corporate governance of the Centre, and the

external relations of the R&D Centre with its partners and sponsors. If there are other existing local research institutions in the focus area, how the R&D Centre could collaborate with them to create synergy;

(k) a general discussion of the long-term organizational plan of the R&D Centre or exit strategy;

(l) the review and monitoring mechanism within the R&D Centre and the longer-term financial projection of the Centre; and

(m) an economic analysis of the benefits brought by the R&D Centre to the industry and Hong Kong.

Monitoring of the performance of R&D Centres

5.18 The performance of R&D Centres will be monitored and assessed at two levels. At Centre level, the Government would assess the performance of the Centre against the stated objectives of the establishment of the Centre and the output of the Centre as a whole. At individual projects level, each project will be monitored in a way similar to how the current ITF projects are being monitored and assessed.

Invitation for Expressions of Interest

5.19 As mentioned above in paragraph 5.5, it is not possible to specify a single model applicable to all R&D Centres and the mode of operation of individual R&D Centres would depend on the nature of the focus areas and the actual proposals received. To facilitate the Government in assessing the level of interest in hosting an R&D Centre under a particular focus area, expressions of interest are invited in this consultation exercise. Interested parties are invited to provide preliminary proposals on the commitment of the host institution, roadmap of the technology development of the focus area, mode of cooperation with other institutions and the industry, etc. The invitation for expressions of interest is non-committal and the information submitted will be used for preliminary assessment for the selection of focus areas and the possible establishment of R&D Centres. Expressions of interest received will neither be accorded with any priority nor preclude any party from submitting formal applications when bids to host R&D Centres are invited.

5.20 Based on comments and preliminary proposals received, we will draw up the list of focus areas and consult the Steering Committee on Innovation and Technology. We plan to issue a formal invitation of R&D Centre proposals in October 2004. Depending on the number of focus areas, the Government may invite proposals in phases.

CHAPTER SIX

WAY FORWARD

6.1 The Government would like to have the benefit of the views of the public, particularly the relevant stakeholders, on the proposed technology focus areas and the proposal of establishing R&D Centres. In more specific terms, we would like to invite views on -

Technology focus areas

(a) definition and scope of the 13 proposed focus areas;

(b) addition or deletion of focus areas; and

(c) key R&D topics under each of the proposed focus areas.

R&D Centres

(a) whether the establishment of R&D Centres could meet the needs of economic, technology and industry development in Hong Kong;

(b) the functions, mode of operation, organization and funding model of R&D Centres;

(c) the need to establish an R&D Centre under individual focus areas, including whether there should be a physical or virtual centre.

6.2 We would also like to invite expressions of interest in hosting R&D Centres, with preliminary proposals on the commitment of the hosting institution, technology roadmap, mode of cooperation with other institutions and the industry, etc.. Interested parties may wish to refer to the checklist for preliminary proposals at Annex C.

6.3 Views and expressions of interest can be submitted to the Innovation and Technology Commission on or before 31 August 2004.

Annex A

Steering Committee on Innovation and Technology

Terms of Reference

In order to optimize the impact of Government's innovation and technology programme and its contribution to our economic development, the Steering Committee will –

(a) advise on the formulation of pertinent policies;

(b) determine focuses and priorities;

(c) ensure effective alignment, coordination and synergy among the stakeholders;

(d) review, where necessary, the institutional arrangements for effective policy and programme implementation; and

(e) advise on the allocation of resources among major elements of the innovation and technology programme to optimize their utilization.

Membership

Chairman

Secretary for Commerce, Industry and Technology

Ex-officio members

Mr Joseph Lee, BBS, JP
Chairman, Applied Research Council

Mr Andrew Leung, JP
Chairman, Hong Kong Productivity Council

Mr Victor Lo, GBS, JP
Chairman, Hong Kong Science and Technology Parks Corporation

Mr Allan Wong, SBS, JP
Chairman, Hong Kong Applied Science and Technology Research Institute Company Limited

Prof Kenneth Young
Chairman, Research Grants Council

Secretary for Education and Manpower

Permanent Secretary for Commerce, Industry and Technology (Communications and Technology)

Commissioner for Innovation and Technology

Other Members

Mr Edward Cheng
Chief Executive, USI Holdings Limited

Prof Paul C W Chu
President, Hong Kong University of Science and Technology

Dr York Liao, JP
Managing Director, Winbridge Company Limited

Prof Tsui Lap-chee
Vice-Chancellor, The University of Hong Kong

Annex B

Detailed Assessment of the Proposed Technology Focus Areas

1. Advanced Manufacturing Technologies

Background

1.1 Advanced manufacturing technologies (AMTs) usually refer to the technologies in the entire chain of processes for the manufacturing of metal and plastic parts and fabrication of precise components and modules. They cover techniques and processes of materials forming, machining, surface finishing, fabrication and assembling of critical parts and components.

1.2 Many foreign countries have set up special programmes to develop AMTs. Examples are the Manufacturing Extension Partnership (MEP) under the National Institute of Standard and Technology in the US, the Regional Centres for Manufacturing Excellence (RCME) in the UK, the Precision Machinery Programme under the Industrial Technology Research Institute (ITRI) in Taiwan, and the CSIRO Manufacturing and Infrastructure Technology (CMIT) in Australia. In the Mainland, Advanced Manufacturing & Automation Technology is one of the six priority areas under the National High Technology Research and Development Programme (also known as the 863 Programme).

1.3 In Hong Kong, AMTs are applied in a wide range of manufacturing sectors of the foundation industries including household electrical appliances, jewellery, watches and clocks, toys, machinery, metals parts and optical parts and components. These sectors have made significant contributions to the Hong Kong economy. For example, Hong Kong is a leading exporter of watches and clocks in the world. In 2001, Hong Kong was the world's second largest exporter of complete watches in terms of both value and quantity, while its export of complete clocks ranked the largest and second largest in terms of value and quantity respectively.[1] Research institutions and technology support organizations in Hong Kong have carried out many AMT projects. The ITF has supported more than 30 AMT related projects with total funding of over $100 million.

[1] Hong Kong Trade Development Council.

AMTs as a Focus Area - Potential Benefits

1.4 AMTs are key enablers to help manufacturers in enhancing productivity, improving quality and reducing cost. The introduction of new AMTs can enhance the competitiveness of local manufacturers and help them explore emerging and niche markets. For example, the die-casting and plastic machinery industry can upgrade their technology in the processing of high value-added magnesium alloy and produce high quality and precise plastic injection moulding machines. With the introduction of advanced functional and decorative surface finishing technologies, plastic and metal products manufacturers can enhance their product quality. Moreover, the development of precision technology will benefit various industry sectors such as those engaging in the manufacturing of spectacle lens, displays, electronics consumer products and projection TV.

Strengths and Opportunities

1.5 Hong Kong possesses a strong R&D base in certain AMTs. In the area of magnesium alloy processing, the HKPC has completed several projects on magnesium die-casting and surface finishing and transferred the technologies to the industry in the past few years. A small cluster of manufacturers with strengths in magnesium processing has been formed. In addition, several research groups in local universities and the HKPC have developed technical competence in advanced surface plating and coating technologies, such as functional and decorative coatings on plastic and metal products, and design and manufacturing of precise optical components.

1.6 With the gradual recovery of the world economy, the demand for small and lightweight durable electronics consumer products is likely to rise. There is a good opportunity for local manufacturers to develop miniaturized parts and components for high value-added electronics products with precision technologies and novel materials.

Risks and Weaknesses

1.7 The watches and clocks industry is a strong foundation industry in Hong Kong but it has been relying heavily on imported movements from Japan and Switzerland. Some local watch manufacturers are concerned that over-reliance on overseas supply of watch movements has limited the potential of further development of the industry. They are planning to develop good quality mechanical watch movements by themselves and, if successful, they may set up assembly facilities in Hong Kong to take advantage of the tariff free arrangement

under CEPA. However, some watch manufacturers are of the view that Hong Kong does not possess enough technical capability to develop the critical components in watch movement, such as springs and precision gears. Without the support of overseas experts, they believe that the chance of success would not be very high.

R&D Centre

1.8 In the preliminary consultation process, the relevant manufacturing sectors supported the establishment of an R&D Centre to develop AMTs. Potential R&D topics include -

(a) technologies for the design and development of the critical components of mechanical watch movements, i.e. springs, gearing systems;

(b) technologies relating to the processing, finishing and recycling of magnesium alloy, such as magnesium sheet metal stamping, small-scale magnesium alloy scrap re-cycling and advanced surface treatment;

(c) technologies relating to advanced surface coating and plating, such as ion plating and plasma treatment processing;

(d) technologies for enhancing the performance of plastics processing machines, such as injection machine controller, intelligent process control technology, injection system for microcellular foam injection and in-mould decoration; and

(e) technologies relating to the manufacturing of precision optical components and systems, such as interferometer, progressive optics, optical screen.

2. Automotive Parts and Accessory Systems

Background

2.1 Automotive manufacturing is not a major industry sector in Hong Kong but many local manufacturers have been supplying a wide variety of internal and external automotive parts and accessory systems (APAS) to overseas

automotive assemblers, including storage batteries, electrical sound/visual signaling apparatus, plastic external trims and accessory systems.

2.2 APAS manufacturing involves over 50 industry sectors, ranging from sectors that are more related to foundation industries, such as manufacturing of plastics internal trims, to high value-added sectors, such as electronics and photonics. It is estimated that there are over 100 local companies in the APAS industry[2] and some of them are engaging in the manufacturing of high value-added automotive parts. However, very few local companies are first-tier suppliers of major automobile assemblers in the US, Europe and Japan. This is due in part to the fact that Hong Kong does not have an established automotive industry and most local companies lack track records of producing good quality automotive parts. Moreover, most foreign automobile assemblers have already had a well-established suppliers network in place and many Hong Kong manufacturers have found it difficult to enter the overseas markets.

2.3 On the other hand, automotive manufacturing is a fast-growing industry in the Mainland. Several large foreign automobile assemblers have formed joint ventures in the Mainland and set up assembly lines in different Mainland cities, such as Guangzhou and Shanghai, to take advantage of the market opportunities and low production cost in the Mainland. Many local and overseas APAS suppliers are trying to gain early access to the booming market in the Mainland.

APAS as a Focus Area - Potential Benefits

2.4 Hong Kong has a strong base of foundation industries with technological strengths in metals/plastics processing, surface finishing and electronics that are useful for the manufacturing of automotive parts and components. Setting APAS as a focus area and establishing an R&D Centre in this area could help local manufacturers adapt and further develop their technological capabilities to seize new opportunities in the automotive industry. A strong APAS industry would benefit many manufacturing sectors, and might lead to creation of new industry clusters as well as job opportunities in Hong Kong.

2.5 At present, there is no major testing platform for APAS in Guangdong Province. Establishment of testing and certification facilities for product quality validation and technology enhancement in Hong Kong may create new employment opportunities for local engineers and technologists.

[2] Hong Kong Productivity Council.

Strengths and Opportunities

2.6 The ITF has supported many projects that are relevant to APAS manufacturing, mostly under the foundation industries programme and the electronics industry programme of the ITSP. Supported projects cover polymers/metals processing (magnesium and advanced plastics processing), surface coating, precision processing of printed circuit board (PCB), and display technologies.

2.7 In the Mainland, total vehicle sales grew from 1.43 million in 1995 to 3.26 million in 2002 at a compound annual growth rate of 12.5%. Total sedan sales grew by 55% year-on-year from 2001 to 2002, and increased by 80% to 2 million in 2003. China was the 7th largest market for vehicle sales in the world in 2001, and is expected to be the 3rd largest by 2010. China's vehicle production as a percentage of global production has increased from 2.8% in 1996 to 4.1 % in 2001.

2.8 Automotive is one of the key industry sectors supported under the national policy. The Guangdong Provincial Government has also identified the automotive industry as one of its pillar industries. As many smaller-scale automobile manufacturers in the Mainland are trying to catch up with the international standards in terms of design, technology and quality, there is a good opportunity for Hong Kong to provide the necessary technologies and components to support the development of the automotive industry in the Mainland.

Risks and Weakness

2.9 Given that APAS is a relatively new industry in Hong Kong, local manufacturers need to establish business relations with their overseas and Mainland counterparts, as well as to build up their reputation and image internationally. Moreover, it may be necessary to set up testing facilities for APAS products to support the development of the industry. This would require substantial input from local research institutions, possibly with support of overseas experts.

R&D Centre

2.10 In the preliminary consultation process, the relevant trade associations, local research groups and technology support organizations shared the view that APAS is an important and promising industry. They supported the

establishment of an R&D Centre in this area and suggested that the Centre could conduct various activities to spearhead and support the development of the industry, such as research in components and technologies, development of management system, and provision of support services, training and networking. Potential R&D topics include -

(a) technologies relating to lighting and electrical systems, such as 42V batteries, LED head and rear lights;

(b) technologies relating to infotainment systems and telematics, such as fibre optic cabling, harness for equipment control and signaling, entertainment and GPS;

(c) technologies relating to advanced materials and processing, such as magnesium alloy processing, hydro-forming of large complicated structural parts;

(d) technologies relating to control and informatics systems, such as energy and pollution management, safety and security devices, and collision avoidance systems;

(e) technologies relating to critical parts and accessory systems, such as smart dampers, air-bags, infra-red night vision, air conditioner and instrumentation; and

(f) technologies relating to the reliability and performance testing of APAS.

3. Chinese Medicine

Background

3.1 Chinese medicine (CM) refers to healthcare practice and approaches based on empirical experiences and indigenous knowledge accumulated over thousand years or more in China for disease prevention, diagnosis and treatment. This technology assessment focuses on Chinese medicinal products only.

3.2 In the Mainland, CM products account for 30–50% of the total medicinal consumption[3]. With its demonstrated efficacy and fewer side effects,

[3] World Health Organization.

CM is increasingly accepted as a form of alternative medicine in the western world. Given its proximity to the Mainland which has the world's richest pool of CM resources and solid CM research and application foundation, Hong Kong is well-positioned to capitalize on these strategic advantages.

3.3 In his 1998 Policy Address, the Chief Executive set forth his vision of promoting the development of CM in Hong Kong. A statutory body and framework have since been established to accord legal recognition of CM and to regulate the practice, use and trading of CM. With a donation of $500 million for CM research by the Hong Kong Jockey Club, the Hong Kong Jockey Club Institute of Chinese Medicine (HKJCICM) was set up in 2001 to transform CM into a high-valued industry by modernization of CM using scientific and evidence-based approaches.

3.4 Implementation of CEPA in January 2004 allows Chinese medicaments made in Hong Kong to be exported to the Mainland free of tariff. This newly instituted free trade pact, together with Hong Kong's robust regime to protect IP rights, strong financial system, skilful workforce and reputation on quality CM products production, have become important factors to attract inward investment to Hong Kong.

3.5 The CM industry in Hong Kong is rather fragmented. The majority of manufacturers of proprietary CM in Hong Kong are traditional small and medium-sized enterprises (SMEs). Nevertheless, some of the big companies with a long history in CM business have gradually expanded and upgraded themselves into modern CM manufacturers by investing in R&D and obtaining local and overseas Good Manufacturing Practice (GMP) accreditation. Many new companies with strong sense of quality assurance and product branding are entering the field, some of which are local conglomerates diversifying into CM business. It is estimated that local CM manufacturers produce about 500 types of proprietary CM, mainly for export to the Mainland, Southeast Asia and North America[4]. The gross output in distribution of CM in 2001 reached over $2.3 billion[5].

3.6 CM is one of the main focuses of R&D in local universities. To foster and strengthen the local R&D capability on CM, a number of CM-related research and infrastructure projects are approved under the ITF to enable local institutions to acquire state-of-the-art facilities and build capabilities to pursue drug discovery, manufacturing process development, analytical characterization and quality control of Chinese medicinal materials. Since its establishment, the

[4] Hong Kong Trade Development Council.
[5] Census and Statistics Department, HKSAR Government.

HKJCICM has also supported 9 research projects on drug development and CM quality control and standardization.

3.7 There is also a rising interest among CM companies in pursuing CM research activities for development of proprietary CM products. Nearly half of the bioscience projects approved under the University-Industry Collaboration Programme of the ITF are CM related, accounted for approximately $53 million.

Chinese Medicine as a Focus Area - Potential Benefits

3.8 Although the global market for herbal medicines stands at over US$60 billion a year and is growing steadily[6], CM products from the Mainland and Hong Kong occupy only a meager percentage of the international herbal medicine market. Modernization of CM to meet internationally accepted standard for safety, quality and efficacy would help CM products enter the European and US markets which are the largest healthcare markets in the world.

3.9 In addition, technology upgrading and new products development are essential to the long-term survival and growth of local CM industry in the highly competitive healthcare markets. It can give Hong Kong a competitive edge in the regional and world market on health food, dietary supplement and new drugs.

Strengths and Opportunities

3.10 Hong Kong, because of its cultural and geographic proximity, has long established a strong relationship with the Mainland to leverage on its wealth of raw materials, expertise and knowledge on CM. Hong Kong has a strong base on biomedical research with international recognition. The universities and institutions engaging in CM research are well equipped with state-of-the-art research facilities. Most of the researchers are trained overseas with extensive exposure and collaboration network in both academia and industries and will help to apply modern technology and scientific approaches to CM research.

3.11 The local CM industry, though comprises mostly SMEs, has maintained strong business ethic and high regard on protection of intellectual property rights. CM products manufactured in Hong Kong have widely won consumer confidence as a guarantee for quality and reliability.

3.12 Western medicine, though effective in treating certain diseases, is

[6] World Health Organization.

sometimes complicated with undesirable side effects. In addition, CM products, shown clinically to have dramatic performance in treating many chronic and systematic diseases such as eczema, have caught the attention of western medicine communities. There is now an increasing trend in developed countries to seek natural medicinal and healthcare products with fewer harmful effects to address both consumer and medical unmet needs.

3.13 Benefited from CEPA and its proximity to the Mainland, Hong Kong is ready to tap into the Mainland CM market. Locally, the integration of CM and western medicine in progress also represents a new opportunity for the local CM companies.

Risks & Weaknesses

3.14 The local market for CM products is relatively small and CM companies have to look abroad for growth. The absence of a harmonized regulatory requirement for import and sale of CM products in the US, Europe and Asia is a great hurdle to CM business development.

3.15 Hong Kong has only limited number of accredited testing centres for local CM product registration purposes. Majority of these centres can only carry out tests for residual pesticides and heavy metals. There are no Good Laboratory Practice (GLP) infrastructure and facility for animal toxicology and pharmacology studies.

3.16 The Mainland, as our most important strategic partner in CM development, is also one of our competitors. The Mainland has identified modern CM as one of the major focuses in its economic development in the Tenth Five-Year Plan (2001-2005). Substantial funding and policy support has been channeled to R&D and commercialization efforts of CM products.

3.17 The worldwide arena of the healthcare sector, both in health supplement and drug development, is extremely competitive. Many large pharmaceutical companies in the US and Europe, although not pursuing development of traditional CM *per se,* are already investing in R&D of modern western medicines using CM herbs.

R&D Centre

3.18 In the preliminary consultation process, both academia and industry were of the view that collaboration between the industry and universities should be strengthened and that research topics should be better coordinated and aligned

with market needs. Since significant infrastructure and facilities have already been built up in the universities, the general view is that there is no need for another R&D Centre. Instead, a virtual centre or consortium with a neutral standing could be set up for coordinating the activities. The virtual centre or consortium could focus on addressing the technology needs of the industry and perform other functions including technology transfer, facilitation of commercialization of CM products, and collection and dissemination of CM-related information.

3.19 It was also suggested that if a new R&D centre or consortium were set up to support CM development, it could be hosted either by the universities or the HKJCICM with focus on providing support and service to the industry, which is currently not covered by the HKJCICM. Examples of such activities are development and upgrade of CM by research on standardization, downstream processing, product formulation and delivery technologies, systematic studies of adverse effects of Chinese medicinal materials and search for substitutes, and production of rare or extinguishing CM plants by using biotechnology.

3.20 Building on the current status of local research capability and CM industry development, R&D on the following topics may complement and facilitate further CM development -

(a) development and upgrade of CM by research on standardization, processing, formulation, dosage form and delivery technologies - the difficulties in standardizing CM because of its multiple constituents in nature are one of the major bottlenecks in CM development. In addition, it is imperative to develop efficient and well-controlled downstream processing technologies such as extraction and concentration for manufacture of consistent CM products. Reformulation of traditional CM dosage form and delivery by modern technologies will further improve the effectiveness and acceptance of CM products;

(b) systematic studies of adverse effects of Chinese medicinal materials and search for substitutes - many herbs that have long been applied in CM practice are found to have some toxic properties. There is a strong need to scientifically justify the benefits against the harmful effects in use of such herbs, seek alternatives with similar efficacy but less side effects, or provide evidence for safe and proper use of such herbs; and.

(c) production of rare or extinguishing CM plants by using modern

biotechnology - to ensure a sustainable and adequate supply of raw materials for continuous CM business development, advanced biotechnology techniques are applied as an important tool to produce some of the rare, high value and protected herbs.

4. Communications Technologies

Background

4.1 The telecommunication sector in Hong Kong is one of the most competitive and fully liberalized markets in the world, currently with six mobile operators operating eleven 2G/2.5G networks, four 3G licensees with one 3G network already in operation, seven Mobile Virtual Network Operators (MVNO), 11 local Fixed Telecommunications Network Services (FTSN) operators, 22 external telecommunications facilities operators, over 200 IDD operators and close to 200 Internet Service Providers (ISP). There is also deep technology diffusion in the community, with currently mobile subscriber penetration rate reaching 106.5%. The PC penetration rate and Internet penetration rate among local companies are 55% and 48% respectively, with over 50% adopting some form of e-business. In 2002, the contribution to GDP by the communications sector is 2.4%.

4.2 To build on this success, the Government has formulated the "Digital 21" IT Strategy since 1998, in which “Wireless Technologies and Services” has been identified as one of the focus areas for technological development. Meanwhile, the ITF has supported over the years a variety of communications projects, including wireless security, wireless multi-media technologies, 3G and ultra wide band development, etc. The ITF has also funded the Hong Kong Wireless Technology Industry Association to set up the Hong Kong Wireless Development Centre at the Cyberport to provide end-to-end infrastructure support for the development of wireless applications.

4.3 The Mainland is also seeing rapid developments in the area. With a population of 1.3 billion and a current mobile subscriber base of 277 million, the Mainland is an important wireless market. Indeed, the mobile terminal production in the Mainland in 2003 has already reached 170 million units, with the import of parts for wireless mobile telephone amounting to US$4.7 billion in 2002. According to In-Stat/MDR, a market research firm, it is estimated that the Mainland mobile market will grow from 206.75 million subscribers in 2002 to 402.28 million subscribers by 2007, with a compound annual growth rate of

10.5% for the forecast period. Mainland companies such as Ninbo Bird, TCL Mobile Communication and Konka are rapidly gaining market shares. Other Mainland companies, such as ZTE and Huawei, have been engaging in high-end telecommunication equipment design and manufacturing.

4.4 With its close geographical, cultural and economic ties with the Mainland, Hong Kong has a high chance to ride on its research expertise, professional competency and comprehensive IP protection to position itself as a research hub to become part of the Mainland's value chain in the supply of critical mobile terminal components and applications to Mainland mobile equipment manufacturers, operators and solution providers.

Communications Technologies as a Focus Area - Potential Benefits

4.5 The benefits of developing communications technologies are multi-fold. On one hand, the community and end-users would stand to benefit as wireless services improve the quality of life and enhance productivity and efficiency. On the other hand, the local industry would benefit from the improved competitiveness through the upgrading of its technological base. A prosperous telecommunication sector would create job opportunities and tradable services, applications or components. In this way, Hong Kong could strengthen its position as the communication hub of the region, create a critical mass of future wireless engineers with product design and innovation experience, and spur additional investment in this area.

Strengths and Opportunities

4.6 Hong Kong has been renowned for its achievement as a pioneer in the adoption of new communications technologies and has been regarded as a test-bed for the industry globally. For example, Hong Kong is the first metropolitan area to have the telephone network digitized in the early 90's, the first to adopt the CDMA standards in the world, the first in Asia to launch Multi-media Messaging Services (MMS) and one of the first to introduce General Packet Radio Services (GPRS). This has put Hong Kong at the forefront of competitive telecommunications services. Moreover, Hong Kong has a strong base of research at the local universities and the ASTRI. They have the research capabilities to develop technologies with potential for commercialization within their spheres of excellence. Building on its local industry strength, professional competency, and strategic gateway position, Hong Kong has the potential to carve out an important role in wireless application and mobile terminal component development.

Risks and Weaknesses

4.7 Along with the great potential, there are equally strong risks due to severe competitions from competitors all around the world. Undoubtedly, the telecommunication industry in Hong Kong has an edge over its competitors in the region in many areas such as penetration of various services and first hand access to advanced technologies. However, competitors are catching up fast. Hong Kong must maintain its vigilance and should not allow its competitive edge to be diluted or eroded.

R&D Centre

4.8 In the preliminary consultation process, the relevant industry and university research groups generally supported the inclusion of communications technologies as a focus area. While the exact organizational nature of an R&D Centre in this area needs to be further discussed, they suggested that the Centre should have a clear role to play to support the local industry. For example, the Centre could help local industry by serving as a technical and business information hub, by active participation in key standards activities, by providing a test-bed for new products and services, and by conducting pre-competitive R&D. Potential R&D topics include -

(a) mobile terminal components – components that facilitate the improvement of mobile terminal operations. This includes computational power improvement (such as a Java engine), common middleware, new feature enablement/feature upgrading, chipset technologies, battery and power management, and human-machine interface; and

(b) wireless applications – initiatives that spearhead emerging applications, provide test-bed across multi-platforms, and support local wireless application development. These include pilot testing, building of test-bed for interoperability and standards compliance testing, and innovative applications or enabling technologies development that add value and features compelling to users. Potential development areas include application platform, mobile commerce, cross-border roaming, wireless networking (e.g. wireless LAN, Bluetooth), wireless multi-media enabling technologies (e.g. H.264, AVS), location identification and related services, Chinese language support and security support, etc.

5. Consumer Electronics

Background

5.1 Hong Kong is a key global exporter in many consumer electronics products including calculators, radios, telephone sets, AV products, as well as related parts and components such as PCBs and LCDs. The electronics industry is the largest export earner of Hong Kong. In 2003 the total exports of electronics products, mainly consumer electronics products, increased by 20% over the previous year to $732 billion, accounting for 42% of Hong Kong's total exports. Traditionally, the US and Europe are the major markets of Hong Kong's electronics products. In recent years, the Mainland has become Hong Kong's largest export market and its importance is likely to grow in view of the expanding consumer market there.

5.2 Although Hong Kong has a strong base of electronics industry, many manufacturers are still in OEM business, taking advantage of the low production cost in the Mainland. However, in today's globalised economy, it is difficult for local manufacturers to compete solely on cost with competitors from the Mainland and other low cost economies. Technology upgrading can enhance the competitiveness of the industry.

Consumer Electronics as a Focus Area - Potential Benefits

5.3 An R&D Centre in consumer electronics could help upgrade the technological capability of the local industry and transform the existing OEM businesses to ODM or OBM. With the capability to develop more innovative products, local manufacturers might be able to increase their shares in the global market. Given the size of the electronics industry, the benefits to Hong Kong could be tremendous in terms of export earning and job creation.

Strengths and Opportunities

5.4 Hong Kong's advanced infrastructure, free flow of information and robust protection of IP rights are conducive to the development of the consumer electronics industry. Moreover, owing to the fast-changing consumer taste and rapid development of electronics and information technologies, consumer electronics products nowadays generally have very short product cycles. Hong Kong manufacturers have been well known for their adaptability and responsiveness to these changes.

5.5 Owing to its proximity to the Mainland, coupled with tariff-free arrangement under CEPA, Hong Kong manufacturers have gained a head-start in entering the Mainland market. Moreover, the Mainland is developing its own standards such as AVS, WAPI, TD-SCDMA, and HDTV standards. Hong Kong manufacturers' connection and knowledge of the developments in the Mainland could place them in a more favourable position than their overseas counterparts in designing new consumer products for the Mainland market.

5.6 Technological advancement and rising consumer expectations, combined with the convergence of computer, communication and consumer electronics, have brought about many new opportunities for product innovation. Digitalization, miniaturization and mobility (via wireless and interoperability) are the key elements for modern consumer products. User interface and product safety are two other basic and crucial elements.

5.7 The demand for digital AV products is expected to grow rapidly in the coming years. The introduction of digital broadcasting in Hong Kong, the Mainland and other countries would create a strong demand for digital AV products. Meanwhile, mass storage technologies have become sufficiently mature for the consumer market, as shown by the increasingly wide availability of flash memory chips and micro-drive hard disks. This has provided a great impetus to digitization of the AV products.

5.8 Aging population has led to rising needs of electronic health-care products worldwide, including the Mainland, which is a potential niche market for Hong Kong. In addition, owing to the rapid economic developments in the Mainland, there is also a huge demand for educational products.

Risks and Weaknesses

5.9 The Hong Kong electronics industry is facing severe competition from Mainland enterprises in the lower end market, and from the conglomerates in Japan, Korea and Taiwan in the higher end market. Most Hong Kong manufacturers are SMEs engaging in OEM business. They generally do not possess very strong technological capabilities in product innovation or manufacturing processes, and are cautious in investing in R&D of new technologies. They may be losing out to their competitors if they do not upgrade their technological capabilities quickly.

R&D Centre

5.10 Since 1994, the ITF and other government funding schemes have

supported 94 electronics-related projects with a total funding of $656 million. However, some of the technologies developed have not been adopted by the industry. There is a need to strengthen the link between industry and universities. In the preliminary consultation process, the relevant industry sectors and university research groups generally supported the proposal that consumer electronics be considered as a focus area. The proposed R&D Centre should develop pre-competitive technologies to support digital AV products, electronic health-care products and educational products. Examples of R&D topics include the following -

(a) critical components and parts – these items, such as application specific ICs, modules and embedded software, have often given rise to technological barriers to manufacturers of consumer electronics products. Other critical components such as optical lens and biosensors are also critical to many applications. Initiatives in this topic should focus on developing critical components and parts that could support a broad line of products;

(b) user interface technology – popularity of consumer products often depends on the user-friendliness of their user interface. Technologies that enable user-friendly design such as voice-activated input systems could provide a key element to provide product differentiation in a competitive market. Industrial design is also important for both cosmetic as well as functional excellence;

(c) miniaturization and advanced electronics packaging – miniaturization is one of the most desirable feature improvements for portable consumer products. Making products small, reliable and at low cost is a continuous challenge for consumer electronics manufacturers;

(d) system integration of new products – consortia could be formed to pioneer the development of "products of tomorrow" in anticipation of the market and technology trends. Examples are Digital Video Recorders, Digital TV Tuners, and Digital Home Entertainment Systems. The challenges would be in achieving product compliance with the various new and changing standards, connectivity to the Internet and between the devices, user-friendliness, low-power consumption and compactness (particularly for portable devices), and lower manufacturing costs; and

(e) infrastructural support – as many audio and video standards are emerging, such as AVS and HDTV standards, it is important for local electronics companies to have timely access to these standards. Active standards participation, standards compliance and testing are important infrastructure support issues. Infrastructural support could also include the provision of technical and market information exchange forum and resource database.

6. Digital Entertainment

Background

6.1 Digital entertainment is a relatively new and evolving industry worldwide. In the updated Digital 21 Strategy published by the Commerce, Industry and Technology Bureau on 4 March 2004, digital entertainment has been identified as one of the technology focuses for Hong Kong in the coming years. As one of the initiatives to facilitate the development of the local digital entertainment industry, a Digital Media Centre has been established at the Cyberport with various facilities, such as equipment for motion capture, audio-visual production, file and disk conversion and disk farm for storage, to spearhead the growth and development of filming, computer generated graphics, game and animation industries.

6.2 The game industry is gaining a significant share in the digital entertainment market and is growing at a rapid pace. New game consoles, such as Sony's PlayStation 2, Microsoft's Xbox and Nintendo's GameCube, are evolving to become the future "digital home entertainment centre" and will probably become the next generation of "networked entertainment server" in everyone's home. According to DFC Intelligence, a US market research firm, the world market for video games and interactive entertainment amounted to US$23.2 billion in 2003. The market for on-line games in the Asia Pacific region was US$640 million in 2003 and is estimated to grow to US$720 million in 2004. Another report from the International Data Corp. also forecasted that the Asia-Pacific region (excluding Japan) would have revenue growth of 19% on a year-on-year basis from online gaming, and would exceed US$1.84 billion in subscription revenue by 2008.

6.3 Hong Kong has a strong domestic market for digital entertainment products. There are some 350 local companies engaging in the fields of digital

effects and post-production, animation production, and development of entertainment interactive and multimedia software. Meanwhile, the Mainland game market is also flourishing, amounting to US$110 million in 2002 and US$230 million in 2003 which represented a growth rate of 187% in 2002 and 117% in 2003. The Mainland market is expected to sustain its growth this year, with an estimated value of US$430 million.

Digital Entertainment as a Focus Area - Potential Benefits

6.4 Although the global game market has huge growth potential, the industry is highly competitive. The local digital entertainment developers need to further enhance their design and development capability. The proposed list of key technologies set out in paragraph 6.8(b) and (c) below could help them achieve this important objective. Local companies can leverage on these key technologies to develop more sophisticated game products with advance features to better serve their customers. In addition to the proposed technologies, the R&D Centre could also provide strategic guidance, such as a roadmap for local game development, and infrastructural support, such as provision of a centralized industry information forum, which would be valuable for the future development of this industry sector.

Strengths and Opportunities

6.5 Hong Kong is known as a city full of innovative ideas in content development and is one of the regional leaders in the field of digital entertainment. For example, the simulation game "Capitalism" has been used by the Harvard Business School and the Stanford School of Engineering as a simulation tool for teaching, and the popular online game “Oriental Heroes of Gu Long Online” claims 240 000 registered users in Hong Kong, Mainland and Taiwan. Another PC game, "Cupid Bistro!!", the first Hong Kong game for the Xbox console has sold for more than 12 000 copies in Japan within six months; another mobile network game, the horse racing game "Super Stable", has been popular in Hong Kong, Taiwan and Macau for virtual horse racing by using handsets. All these examples clearly show that Hong Kong has the capability and talents to produce innovative and high quality digital entertainment content.

6.6 There is a strong demand for digital games in Hong Kong. A recent study found that among people between the age of 10 and 29, 34.1% have played

on-line games and they spent on average 10 hours or more on on-line games per week. The total population of young on-line gamers is estimated to be more than 400,000, while the number of on-line game centres or cyber cafes is estimated to be over 400. The Mainland market is another market that should offer a great opportunity for the local developers to expand their business.

Risks and Weaknesses

6.7 Local digital entertainment developers are facing severe competition from their counterparts in the region. For example, Korean game developers have been a dominant force in the regional markets. Recently, the Mainland has placed a lot of attention and resources on game development and many Mainland companies have already begun investing heavily in the design and development of new games.

R&D Centre

6.8 In the preliminary consultation process, it was suggested that new technologies and infrastructure would be required to enhance the competitiveness of the local game development industry. Potential R&D topics are -

(a) infrastructure for game development – to provide facilities and measures that add competitive strengths to the game industry. Examples include common development platforms in networking and wireless interface, test support for games on different platforms, digital rights management, in-depth study on game technology development and market movements, engagement of overseas experts for local mentorship, and facilitation of market segment expansion to include edutainment as a major development area;

(b) enabling technologies for game engines – to develop technologies that enable game engines to be developed more effectively and efficiently, such as physics engine, 3D environment engine, AI engine, Chinese style character animation and Kung-fu motion capture; and

(c) enabling technologies for game servers – to develop technologies that enable game servers to be developed and operated more competitively. Examples include grid computing for game server farm, interactive gaming under bandwidth constraint, network

security, video shearing, payment and game commerce.

7. Display Technologies

Background

7.1 With the rapid development of information technology and growing demand for consumer electronics products, electronic parts and components continue to constitute a substantial portion of Hong Kong's electronics exports. In particular, LCD panel has become a critical and high-value component of telecommunications and electronics consumer products, such as mobile phones, personal digital assistants, monitors, laptop computers, digital and video cameras and television sets.

7.2 The Greater PRD region is the world's largest manufacturing base for twisted nematic (TN) and supertwisted nematic (STN) display screens and modules. In Hong Kong, there are many display companies engaging in OEM production of LCD modules and light-emitting diodes and some of them are looking into other rapidly evolving display technologies, such as organic light-emitting diode (OLED), bi-stable LCDs, and projection light engines based on liquid crystal on silicon (LCoS). Three major local display manufacturers have already licensed OLED technology from Kodak and several other companies are also considering developing OLED.

Display Technologies as a Focus Area - Potential Benefits

7.3 The current market size for the display industry is estimated to be over US$70 billion. According to iSuppi/Stanford Resources, a marketing and technology research firm, LCD, OLED and plasma display panels are expected to contribute a strong growth in the coming few years. It is a great opportunity for Hong Kong as our local display industry has developed a strong base in manufacturing various types of display devices, in particular LCD. Development of display technologies would help local manufacturers further upgrade their technological capability for new opportunities in the display market.

7.4 There are many new technologies involved in the display technology area. R&D in the area would enable local display manufacturers to enhance their capability in manufacturing other high-value display devices, modules and systems. Technology upgrading can also enable display manufacturers to develop other promising displays based on active-matrix technology.

Strengths and Opportunities

7.5 Given China's economic success, the demand for electronic parts and components such as flat panel display components in the Mainland is expected to rise. This presents enormous market opportunities for Hong Kong's display manufacturers. As estimated by iSuppi/Stanford Resources, the global revenues from OLED display will grow to more than US$1.7 billion by 2007. The firm also forecasted that OLED display has the strongest compound annual growth rate at 76% from 2000 to 2006 among all the display components. In addition, the firm suggested that 2005 would be a turning point for the Mainland's OLED industry to flourish as the business enters a mass production era.

7.6 Hong Kong has a strong R&D base in display technologies and many research groups in universities, the HKPC and the HKSTPC are dedicated to R&D in this area. Many display companies are also investing in the R&D of different display technologies.

7.7 Hong Kong has developed research capabilities in advanced materials for displays, structure design for display devices, OLED technologies, such as area-color OLED panel for automotive display applications, and LCD technologies, such as bistable LCD display for low power applications, and micro-display for projection display systems. Given this background, Hong Kong could leverage on its strengths and the strong production capacity in the Greater PRD to help the local display industry play a leading role in the development and production of various high-value display products.

Risk and Weakness

7.8 Competition in the global display market is very keen and many neighbouring economies including Japan, Korea and Taiwan are investing heavily in various display technologies such as active-matrix OLED and TFT-LCD. Display technologies is also one of the priority technology areas for development in the Mainland. Many Mainland companies have set up OLED R&D centres and some of them have also formed alliances to develop OLED technology.

R&D Centre

7.9 In the preliminary consultation process, the relevant industry sectors and university research groups were of the view that OLED would become an important display technology in a few years' time and Hong Kong's experience in the manufacturing of LCD would be useful for developing passive-matrix OLED

display technology. It was suggested that passive-matrix OLED displays should perform better than colour STN displays and competition in passive-matrix OLED would be less keen than that in active-matrix OLED.

7.10 To develop OLED, it is necessary to carry out R&D on enabling technology for the manufacturing of passive-matrix OLED, materials for OLED devices, effective device structures, display module rapid prototype design and manufacturing tooling. In addition, engineer training in the manufacturing processes such as material and luminescent device fabrication would also be required. It was suggested that the major display manufacturers and the Government could form a consortium and set up a pilot production line to carry out R&D on OLED technology and related manufacturing process. Moreover, there should be more coordination and collaboration among various research institutions and industry players that possess expertise in different areas of display technologies. This may be achieved by establishing a virtual centre.

7.11 Other potential R&D topics in display technologies include LCoS light engine and bi-stable LCD. They can support the development for applications such as near-to-eye projection display, high definition television, rear projection television, e-paper, micro-display, and displays for low power consumption.

8. Integrated Circuit Design

Background

8.1 For most electronics products nowadays, major product functions are incorporated into IC chips. ICs are the core technology of these electronics products, and IC design is the most important portion of the value chain of electronics manufacturing.

8.2 The electronics industry is Hong Kong's largest export earner. In 2003 the total export of electronics products has increased by 20% over the previous year to $732 billion. There has been an increasing demand of IC chips from Hong Kong manufacturers. However, most local manufacturers still source their critical IC components from overseas suppliers. Over-reliance on overseas IC suppliers has limited their ability in product innovation and their profitability.

8.3 The IC market is forecast to grow substantially from 2003 to 2005 due to the high demand from the Asia-Pacific region, particularly the Mainland and Japan, on consumer products such as DVD recorders, mobile phones and

personal computers. According to a recent survey, the Mainland alone accounts for 25% of semi-conductor demand in the Asia-Pacific region.

8.4 The Mainland has well recognized the strategic importance of the semi-conductor industry and has identified IC design as one of the key industries in the Five-year plan. Tax incentives have been provided to the IC design industry and many IC fabrication foundries have been set up in the Mainland. The Ministry of Science and Technology has designated regional IC design centres in seven major cities (i.e. Beijing, Chengdu, Hangzhou, Shanghai, Shenzhen, Wuxi and Xian).

8.5 Hong Kong also supports the development of the IC design industry and the ITF has funded projects ranging from specific IC product development to setting up of infrastructure. The Semi-conductor Product Analysis and Design Enhancement Centre at the Hong Kong University of Science and Technology and the IC Design and Development Support Centre at the Science Park have been set up with a total funding of $91 million. The HKSTPC has also teamed up with the seven regional IC design centres in the Mainland to form a strategic alliance, known as the "7+1" arrangement.

IC Design as a Focus Area - Potential Benefits

8.6 Despite the cyclical downturn in recent years, the world semi-conductor market has recorded an average growth rate of over 10% per annum in value terms over the past three decades, reaching US$166 billion in 2003. In view of the strong local and global demands of semi-conductor components, IC design can grow by itself into a high-value added industry in Hong Kong. Moreover, a strong IC design industry can support the development of other technology focus areas such as consumer electronics, communications technologies, and medical diagnostics and devices.

8.7 At present, local manufacturers source their IC components mainly from overseas suppliers. With more locally designed ICs, local manufacturers would have more control over price and availability of IC components. If local manufacturers were close to their IC designers, they would be able to respond more quickly to market changes by modification/upgrade of their products with new design of the critical ICs. Moreover, IP rights associated with product innovation could be built into ICs. This process would provide a reliable avenue to protect IP rights and would further encourage product innovation that is important to the electronics industry in upgrading itself from OEM business to the more profitable ODM business.

Strengths and Opportunities

8.8 Geographically, Hong Kong is conveniently located at the centre of many nearby foundries in Korea, Singapore, Taiwan and the Mainland. Moreover, IC design involves intellectual properties. Hong Kong has a robust IP protection regime backed up by a well-respected legal system, and this is a favourable factor to support the development of the IC design industry.

8.9 Hong Kong manufacturers have been well known for their adaptability and responsiveness to market and technology changes, and have been doing well in consumer electronics. There is already a big local market for ICs in the PRD and the rest of the Mainland.

Risks & Weaknesses

8.10 Hong Kong needs a large pool of IC design professionals to support the development of the industry. However, Hong Kong companies are mostly SMEs which do not possess strong capability in product innovation and are cautious in investing in product design and development. At present, only a small number of IC design teams can be found in certain big companies and in fabless design houses.

8.11 IC design is part of a complete semi-conductor product development cycle. While expensive EDA tools are required for IC design, other types of equipment are also needed for other parts of the cycle, such as wafer fabrication, packaging, wafer bumping, testing, etc. Currently, most Hong Kong IC design companies have to rely on overseas companies to perform these tasks.

R&D Centre

8.12 In the preliminary consultation exercise, the relevant industry sectors and university research groups were of the view that IC design has good development potential and should be considered as a focus area. They suggested that good infrastructure has already been set up in the Science Park to cater for IC design and development. The industry should be encouraged to make good use of such infrastructure to enhance its capability in product innovation and development.

8.13 A potential R&D topic is to develop ICs for consumer electronics products, such as radio frequency ICs for wireless applications, low power and low voltage ICs for portable products, power management chips, and low cost ICs for toys and AV products. Measures should also be taken to improve the

accessibility of IP cores for the IC design industry and to improve the infrastructure for IP sharing for cost reduction.

9. Logistics/Supply Chain Management Enabling Technologies

Background

9.1 Over the years, Hong Kong has built up its reputation as a world-class logistics hub. Endowed with a deep-water harbour strategically located along a major sea route and with the Mainland providing a huge cargo base, Hong Kong has been the world's busiest container port for many years. The volume of international freight handled at the Hong Kong International Airport is also among the highest in the world, amounting to nearly 2.64 million tons in 2003. In 1999-2002, transportation and logistics related sectors (including freight and passenger transport) account for over 7% of our GDP, employing over 210 000 workers. Every day, over $2 600 million[7] worth of goods are produced by tens of thousands of factories scattered over Mainland, shipped to Hong Kong for export. Such export activities require quality logistics support to keep the supply chains intact and efficient. Hong Kong's logistics facilities and services have contributed significantly to the PRD's rapid rise as a major manufacturing base in the world, supplying large volume of commodity items to the world market. Hong Kong's role as a logistics hub and gateway to the Mainland has been further enhanced by CEPA.

9.2 Speedy response to customer demands and high degree of controllability are critical advancement targets for the logistics/supply chain management (SCM) industry. Availability of accurate information holds the key to such advancements. Radio Frequency Identification (RFID) is an emerging, disruptive technology that could revolutionize the whole industry by enabling an unprecedented level of data collection and networking capability to logistics/SCM solution providers. The RFID chips, of which the size could be as small as 0.3 square millimetres, can be added to almost any object from the pallet level to the product item level to identify uniquely the goods in transport. Coupled with a global information network, such as the EPCglobal Network, RFID-based logistics management will significantly improve the visibility of products flowing along the supply chain. Each of these products will have its own unique product code so that all stakeholders along the supply chain including manufacturers, distributors and retailers will be able to have instant access to information about an individual product, including its location on the way to the

[7] Hong Kong Trade Development Council.

destination. Such visibility enables the related business to have real-time control and a quick response to changes in demand and traffic situations along the supply chain.

9.3 The development of RFID is gaining momentum on the international front. The Yankee Group, a research firm, estimates that RFID technology will be a US$4.2 billion market by 2008. The Venture Development Corporation, a technology market research firm, also estimates that the market of RFID software and systems will expand at a compound annual growth rate of 37% for the period of 2003 through 2005. Many worldwide top retailers, such as Wal-Mart, Target, Tesco, and Metro Group, have pledged their support to the technology and are actively taking steps to adopt RFID in their operations. For example, Wal-Mart has mandated its top 100 suppliers to be RFID compliant on the pallet and case level by 1 January 2005, and the remaining suppliers by 1 January 2006.

9.4 In view of the above developments, it is timely for Hong Kong to acquire the knowledge and to build up the necessary technology base so as to reinforce its position as the preferred international and regional logistics hub and a supply-chain management base.

Logistics/SCM Enabling Technologies as a Focus Area - Potential Benefits

9.5 The benefits of developing logistics/SCM enabling technology are multi-fold. By increasing the visibility of critical elements in the supply chain, the industry could achieve substantial saving through better inventory management, reduction of product shrinkage and improvement in supply chain efficiency. In turn, the overall competitiveness of the industry and quality of service would increase and thereby reinforce Hong Kong's role as the logistics hub of the region. On the other hand, such development aligns with the global trend to move towards a RFID-based supply chain. The swift adaptation of the new technology would give the local IT industry the early mover advantage and facilitate the upgrade of the technological base in general. The setting up of an RFID R&D Centre also helps to boost the confidence of the local SMEs in the adoption of the technology. In time, new industry or investment may be spurred to make this area a sustainable edge for Hong Kong.

Strengths and Opportunities

9.6 Hong Kong has an excellent transportation infrastructure to support global logistics operations. It has also a well-established communication infrastructure and IT knowledge base to meet the growing demands on the

supporting IT system. In terms of knowledge base, Hong Kong has a strong R&D and industry base. There are various academic departments and research groups in the local universities that are dedicated to logistics-related IT system and methodology research.

9.7 The need for efficient global supply chain operation is ever increasing with the global trend that trading across nations gradually taking over trading within nations. In addition, the total amount of exports and imports in the PRD has recorded a growth rate of 24% and 90.8% respectively from 2001 to 2002 according to Guangdong Statistical, an official publication in Guangdong. Hong Kong is in a good position to benefit from these huge volume transactions.

Risk and Weakness

9.8 Along with the great potential, there are equally strong risks due to the severe competitions from competitors all around the world. There are some uncertainties with regard to compatibility issue among competing international standards, the local industry's awareness and receptiveness to the new technology and the potential replacement of RFID by other emerging technologies.

R&D Centre

9.9 In the preliminary consultation process, the relevant industry sectors and technology support organizations supported logistics/SCM enabling technologies, particularly RFID, be considered as a focus area. Potential R&D topics are -

(a) facilitation of EPCglobal Network implementation – the goal is to facilitate instant access to product information and further development of the technology. This includes the provision of EPC-related technologies and infrastructure (e.g. Physical Markup Language (PML) servers, Savant-enabled readers, etc), and the facilitation to establish local/ regional Object Name Service (ONS);

(b) long-term support on EPC-enabled supply chain management – the goal is to enhance the overall efficiency of the supply chain operation. This includes backend processing technology (such as legacy application integration with EPCglobal Network, global data synchronization, etc.), product item level RFID enabled supply chain management, and supply chain business process integration technologies;

(c) piloting RFID-based application platforms – in addition to logistics/SCM-related applications, other examples include counterfeit prevention, security application against industrial sabotage or security application against industrial espionage; and

(d) infrastructure support on RFID technologies – the goal is to offer general assistance to end-users as well as local hardware and software solution providers by providing a resource database, information exchange forum, training, and coordinating participation in standards activities.

10. Medical Diagnostics and Devices

Background

10.1 Medical diagnostics and devices (MDD) include the use of multi-disciplinary technologies to produce a broad range of devices, equipment, and diagnostic tests for medical use. The demand for MDD is increasing worldwide due to the increased life expectancy and aging populations, focus on early diagnosis and preventive therapies, advancing medical sciences, and demand to improve the quality of life. Together with the new developments in biotechnology, electronics, information technology and optics/photonics, innovative technologies and engineering principles are rapidly being introduced to solve problems in medical diagnostics and healthcare.

10.2 It is estimated that the global medical and healthcare device market has exceeded US$150 billion per year, among which diagnostic and imaging equipment account for about 25% of the whole market[8]. Countries such as China and India will have the greatest growth potential due to their large population and developing healthcare system. Southeast Asian countries will also exhibit high growth as their economy and healthcare systems continue to improve.

10.3 The local MDD industry is a new and emerging industry consisting of two main sectors. One sector is the diagnostics reagent companies engaged in developing diagnostic tests and systems, and in providing diagnostic services for hospitals and laboratories in Hong Kong. Another sector is the medical device companies with manufacturing base in the PRD, mostly engaged in OEM business. Profit margins for these companies are limited as critical components

[8] Kelly Science and Healthcare Services Group.

and manufacturing technologies have to be imported from overseas.

10.4 Through the ITF, the Government has supported a number of projects related to MDD. Some of the projects have achieved significant development in their respective areas, and the research results of some projects have been successfully transferred to industry for commercial applications.

Medical Diagnostics and Devices as a Focus Area - Potential Benefits

10.5 The multi-disciplinary focus area would help integrate expertise from biomedical sciences and engineering, and strengthen the coordination among various institutions and industries to create greater synergy and impact. This integration would facilitate the establishment of new clusters and enhance the growth of the biotechnology industry, which is an important industry in the knowledge-based economy.

10.6 Local medical device manufacturers are mostly engaged in OEM. The proposed R&D centre would help upgrade the industry from OEM business to high value-added ODM and OBM businesses. In addition, the involvement of the industry would help accelerate the process of transforming research ideas into new products for commercial applications through technology transfer from universities. The developing MDD industry would provide employment opportunities and training for workers in this area and help reinforce Hong Kong's strengths in medical services and products.

Strengths and Opportunities

10.7 Universities in Hong Kong possess state-of-the-art research facilities and are internationally competitive in pursuing research in genomics and biotechnology-related fields. To address the need for multi-disciplinary knowledge required by the area of MDD, some universities are rapidly building up their research strengths and capabilities through activities and programmes that integrate engineering sciences with medical sciences. The medical schools in Hong Kong are of high standard and can provide support to industry through evaluation of the technologies and products, and clinical validation.

10.8 The proposed focus area requires the integration of medical sciences and other technology industries like electronics, information technology, etc. The Hong Kong electronics device industry is recognised for its good quality in manufacturing and management among Asian countries, and enjoys good reputation for product reliability worldwide. Most diagnostics devices do not

require extremely sophisticated manufacturing process and thus fit the capability of many Hong Kong manufacturers.

10.9 There is a growing trend globally within the medical diagnostic testing marketplace for minimally invasive devices and early and more accurate diagnosis. The result of these allows for less medical treatment, personalized medicine and substantial savings.

10.10 As a result of rapid economic development in the Mainland, the consumption of healthcare products in the Mainland is rising quickly but is still far below the developed countries. Leveraging on its geographic advantages, Hong Kong can make use of its scientific competitiveness to establish a key role in the medical diagnostics market in the region.

Risks and Weaknesses

10.11 Specialized facilities for product validation, testing and approval of medical devices products are not available in Hong Kong. Many testing services have to be contracted out to overseas laboratories at a high cost. Similarly, supply of consultancy services and training for compliance with international regulatory requirements are limited in Hong Kong. As such, Hong Kong companies often experience difficulties when trying to assess other markets.

10.12 The local MDD industry, comprises primarily OEM companies, is facing severe pressure from low cost competitors for the low end products. Strategically, there is an urgent need for the industry to be upgraded to produce higher value products with more technology contents.

10.13 The process of translating research results from laboratories to commercial applications involves many inter-linking steps. The lack of mid-stream R&D capabilities would restrict the ability to turn upstream research in the universities into commercially viable products. The industry, on the other hand, is not familiar with the services and expertise of the universities.

R&D Centre

10.14 In the preliminary consultation process, the relevant industry sectors and other stakeholders generally supported the establishment of an R&D Centre in this area. A self-sustainable R&D Centre, with initial support from the Government, is recommended. It is envisaged that the R&D Centre could provide a focal point for industry-university collaborations, and coordinate

resources from various disciplines and institutions. The Centre could carry out R&D activities and benefit the industry sectors through the transfer of technologies developed from R&D projects. Within the Centre, consortia could also be formed for development of specific technologies or solutions, with financial contributions from the consortia members. The Centre should have its own core staff but cooperation and participation of different sectors, including up-stream, mid-stream and down-stream sectors, are necessary as the expertise in developing, testing and producing new products are spread out among different sectors.

10.15 Based on the research strengths and capabilities in the local academia and industry, further development in the diagnostics field can be achieved by better coordination of the universities' expertise and leveraging with industry. Potential key topics are -

(a) medical imaging for diagnostics – the global diagnostic imaging market is projected to increase from $4 billion in 1999 to $5.4 billion by the end of 2005[8]. Medical imaging is an area in which Hong Kong researchers have good expertise. Examples of sub-topics for further R&D include high resolution imaging technologies, medical imaging software, signal processing and transmission;

(b) in vitro diagnostics (IVD) – the development of IVD making use of genomic information to diagnose a medical condition, predict the likelihood of developing a particular illness or predict the efficacy or toxicity of drugs has experienced unprecedented growth in the past few years. Hong Kong's genomics and molecular research is internationally competitive, as demonstrated by its scientific contribution to SARS and bird flu. There are also a number of world-class scientists in the field of medical microbiology with regional interest such as influenza, hepatitis B and EBV. Major stakeholders can help transform this knowledge into marketable diagnostics products. Combining Hong Kong's traditional strengths in information technology, IC design and electronics, the products developed can become significant tools to address the soaring demand for rapid and accurate diagnosis in the world. Potential sub-topics are community-based and home-based devices, biochips, molecular diagnostics and new disease-related biomarkers for rapid

[8] Business Communications Company, Inc., 2002

diagnosis; and

(c) biosensors - the global biosensor market is projected to increase from US$2 billion in 2000 to over US$8 billion by 2005[9]. The demand is overwhelmingly dominated by clinical diagnostics. Technologies for further R&D include sensor coating and manufacturing technologies, micro-fabrication, signal capturing, programming and data analysis.

11. Nanotechnology and Advanced Materials

Background

11.1 Owing to its enormous potential economic benefits, nanotechnology is widely regarded by industrialized countries as one of the most important technologies in the coming decades. According to the National Science Foundation of the US, the worldwide annual industrial production in the nanotechnology sectors could reach US$1.1 trillion by 2010-2015. The US and many Asian and European Union countries have initiated large-scale national programmes for the development of nanotechnology, including establishing centres of excellence in specific topics in nanotechnology. In the Mainland, advanced materials (including nanomaterials) is one of the priority areas under the 863 Programme.

11.2 Hong Kong has also recognized the importance and potential of nanotechnology. The Innovation and Technology Commission has included nanotechnology as one of the solicitation themes of the ITF and has supported many nanotechnology-related research projects in the past few years. In 2003, the ITF approved allocations of $56.9 million and $12.5 million respectively to support the establishment of the following two nanotechnology centres by local universities -

(a) the Institute of NanoMaterials and NanoTechnology at the Hong Kong University of Science and Technology, which aims to develop functional nanomaterials and technologies for applications in energy storage, nanoelectronics, nanomaterials manufacturing and environmental nanocatalysts; and

(b) the Nanotechnology Centre for Functional and Intelligent Textiles

[9] Report by Frost & Sullivan

and Apparel at the Hong Kong Polytechnic University, which aims to improve properties of fabrics and develop intelligent textile apparel products through the application of nano-finishing and nanotechnology.

Nanotechnology and Advanced Materials as a Focus Area - Potential Benefits

11.3 To maintain their competitiveness and explore new business opportunities, the Hong Kong industries need to upgrade their products and improve their manufacturing processes and productivity. Nanotechnology and advanced materials technology offer a powerful enabling technology platform that will lead to a wide spectrum of innovative products. These technologies can be applied in sectors ranging from textile to telecommunications and biomedical, to add new features or enhance performance of products.

Strengths and Opportunities

11.4 It is believed that the nanotechnology era has just begun and, relatively speaking, Hong Kong can compete on equal footing with other economies in this technology area. There are many experts in the areas of nanotechnology and advanced materials in local universities and some of their research results are highly regarded in the international arena. We have already built up substantial research strengths and infrastructural support in nanotechnology.

11.5 The ITF has supported a number of projects that are relevant to nanotechnology and advanced materials. For example, the nano-photocatalytic coating technology developed under an ITF project has been successfully transferred to a local company for the development of air filter and water filter.

11.6 Moreover, the Greater PRD region is a major manufacturing base in the world. It provides an ideal platform for application for innovative ideas and commercialization of new technologies.

Risks and Weaknesses

11.7 Other countries and economies are also investing heavily in nanotechnology and advanced materials. For example, the US has approved a national nanotechnology investment of a total budget request of US$849 million in 2004. Similarly, Japan plans to spend about US$855 in R&D of nanotechnology and advanced materials in 2004. Hong Kong needs to move quickly to avoid being left behind in this technology area.

R&D Centre

11.8 In the preliminary consultation process, the relevant industry sectors were of the view that the present research programmes, facilities and services relating to nanotechnology and advanced materials should be further strengthened to meet the industry needs and to enhance its long-term competitiveness. It has been suggested that the proposed R&D Centre should facilitate and support the application of nanotechnology and advanced materials by the industry. Proposed activities of the R&D Centre can be divided into the following three categories -

(a) nanotechnology – development of technologies that enable the applications of nano-sized particles, nano-sized polymers, nano bulk materials/composites/porous materials in different industrial sectors, such as nano-sized particles for polymer composites, nano-coated wrinkle-free fabrics, nanocatalyst-based paints and air purifiers, nanomaterials for construction, nano sensors and fast release drugs;

(b) advanced materials technologies – development of advanced thin film/coating technologies that enhance functional properties, improve efficiency and facilitate manufacturability of critical parts and components; advanced magnetic materials for information storage; advanced materials in electronic packaging; and advanced metallic/polymer composite materials, light and hard metallic materials for industrial applications such as watches, automobile parts and components, and electric and electronics products; and

(c) infrastructure support – provision of facilities and services to help industry develop nano products; establishment of standards to verify the "nanotechnology performance" of products; dissemination of authentic information on nanotechnology and advanced materials; facilitation of information exchange and collaborative development; and provision of training and technology awareness programs for industry.

12. Opto-electronics

Background

12.1 Opto-electronics is an enabling technology platform for a wide

range of applications in areas such as communications networks, industrial applications and lighting. The market focus prior to 2001 was on telecommunication applications, but it has recently shifted to datacom and other short-distance applications. The trend is to bring opto-electronics enabled systems into consumers' daily lives. Worldwide markets for optical networking equipment and LED are estimated to be over US$10 billion[10] and US$3.2 billion[11] respectively in 2004. The Mainland alone imported opto-electronics products totaling US$1.48 billion[12] in 2002. The fast growing opto-electronics industry presents new opportunities for Hong Kong. With its strengths in opto-electronics R&D and IP protection, Hong Kong could serve as an opto-electronics R&D IP supply center to complement the existing manufacturing strength in opto-electronics in the PRD.

12.2 Hong Kong has a strong research base in opto-electronics. Many research groups at local universities are conducting research work in this area. The ASTRI has identified photonics as a key strategic area, while the HKSTPC has identified opto-electronics as one of the strategic clusters in the Science Park and is establishing a Photonics Development Support Centre. In the past three years, the ITF allocated about $40 million to support opto-electronics related projects through the ITSP.

Opto-electronics as a Focus Area - Potential Benefits

12.3 Opto-electronics is a fast-growing technology area. Through partnership and licensing arrangements, technologies generated under projects of the proposed R&D Centre can be transferred to local industry. Some of the technologies have great market potential and are disruptive in nature. They therefore can provide a rare, valuable opportunity for many local electronics companies to leap-frog to a higher technological platform better suited for global competition. An R&D center in opto-electronics can also provide strong support to an emerging group of local opto-electronics start-up companies in Hong Kong by providing them access to a broad technology resource base, by helping them with technical marketing guidance, and by offering them technical manpower training.

Strengths and Opportunities

12.4 There are many strong opto-electronics research groups in local universities and ASTRI. The opto-electronics laboratories of these institutions

[10] KMI Research.
[11] CIR Inc.
[12] China Customs Statistics

are equipped with world-class facilities and serve as ideal training grounds for technical personnel and students. These research groups have demonstrated capabilities in conducting R&D and helped put project results into commercial use. As an example, Acasia Ltd., originally part of the photonics research group in the ASTRI, was successfully spun off from the ASTRI in April 2004. In addition, Hong Kong has well-established electronics and precision engineering industries which can offer valuable support to the opto-electronics industry. Hong Kong is also in close proximity to a large number of opto-electronics manufacturers in the PRD.

12.5 Excellent opportunities have emerged from the strong manufacturing sector and fast-growing economy in the Mainland for new opto-electronics components and systems. For example, businesses in home network and automobile manufacturing are growing rapidly, which may lead to increasing demand in short distance optical networks. High brightness LEDs will be a good candidate for new energy-saving light sources for both indoor and outdoor lighting. Opto-electronics sensors have found increasing applications in construction and industrial areas. Recently, some European and North American opto-electronics companies are setting up branch operations in or relocating to Asia, where a good proportion of the market is. This presents a good opportunity for local companies to cooperate with or to support these foreign companies.

Risks and Weaknesses

12.6 The local opto-electronics industry is rather fragmented and there is no opto-electronics cluster in Hong Kong yet. Overseas markets and foreign suppliers play important roles in this industry. Most local companies would require assistance in technical marketing and in promotion of their products overseas. Many of them also rely on foreign suppliers for critical components or technologies. The local industry also faces strong competition from Japan, the Mainland, South Korea, Taiwan and Singapore.

R&D Centre

12.7 Proposed focuses of the R&D Centre include pre-competitive stage R&D projects and providing assistance in technical marketing and manpower training. R&D projects to be carried out may involve many local institutions and companies. It is necessary to form a close relationship among the principal parties to drive the projects. Potential R&D topics include the following -

(a) short distance optical network - recent shift in market focus has directed increasingly more attentions towards consumer application

systems based on medium to short distance networks. Examples include Fiber-To-The-Home (FTTH) systems, opto-electronics-based home networks, and other consumer-type applications. Opto-electronics systems are also playing an increasingly important role in automotive applications, for example in infotainment and safety areas, due to their excellent immunity to electromagnetic interference (EMI). These innovative applications present excellent commercial opportunities and plenty of technical challenges for system development. They also provide the stimulus for development of a wide range of critical components (both active and passive). Examples of these components include photonic transceivers, optical amplifiers and opto-electronics integrated circuits (OEIC), and LED devices;

(b) solid-state lighting - due to its ability to deliver high-quality light and its great energy saving potentials, solid-state lighting attracts much attention in research lately. New devices being developed are not confined to color LEDs. There are intense research efforts to develop white LED with emitting intensity comparable to that of conventional light bulbs. LED lighting has gradually gained popularity in specific application areas, for example, as traffic light, indoor architectural lights, rear lights and turn signals in automobiles. However, much more R&D efforts are still required before the full potentials of bright LED can be realized in the commercial world;

(c) industrial use opto-electronics - opto-electronics systems have many applications in industrial use. For example, high power lasers are used for cutting, marking and welding on hard material, such as metal, that previously required heavy machineries. In addition, opto-electronics sensors are being developed to detect changes in pressure and material strain in order to monitor structures such as bridges and railways. Recently there is an increasing trend of putting opto-electronics sensors into medical use. "Bio-photonics" has emerged as a new application area, combining opto-electronics technology with biotechnology. All these application areas hold great business potential. However, development of local industry in these areas is in the early stage. In the case of "Bio-photonics", cross-disciplinary support is needed from the medical diagnostics and devices industry sector; and

(d) opto-electronics packaging - new opto-electronics applications call for new technical specifications such as temperature tolerances and

hermetic requirements. It is necessary to develop packaging techniques to meet the new specifications and requirements for the components developed.

13. Textile and Clothing

Background

13.1 Textile and clothing is one of the major manufacturing sectors in Hong Kong. Hong Kong produces and exports a wide range of textile and clothing products and is the world's second largest clothing exporter after the Mainland. With innovative design and quality products, the local industry has successfully established an up-market image worldwide.

13.2 Many foreign countries have taken steps to support their textile and clothing industry. For example, the US Textile and Clothing Technology Centre conducted the "Apparel on Demand" project to carry out research on 3D body scanning and related technologies. Korea has also invested over US$570 million in the "Milano Project" which aims to upgrade the textile and clothing industry through enhancement of fashion design techniques, materials and production technology improvement, and infrastructure development. Recently, Singapore has planned to develop its textile and clothing industry, with emphasis on high value-added production technology.

13.3 The local textile and clothing industry has over the years developed various enabling technologies in the product design, development and production processes. After the implementation of CEPA, a wide range of textile and garment products can be exported to the Mainland free of tariff. On the other hand, the complete removal of the quota system in 2005 under the WTO Agreement will bring enormous changes to the industry. To meet the challenges ahead, the local industry needs to build on its existing strengths and develop innovative, high value-added products.

Textile and Clothing as a Focus Area - Potential Benefits

13.4 New technologies will benefit various sectors of the textile and clothing industry. For example, advanced garment technologies could enable the development of intelligent systems to enhance production efficiency and product quality. With regard to textile materials (e.g. fibers/yarns), nano-materials and related processing technologies can be applied in the processing of smart and intelligent materials and the production of novel yarn.

13.5 Moreover, advanced 3D fabric design and simulation system can be used to analyze fabric construction and function. The analysis results would be useful for the production of sophisticated design and functional fabrics for high-end markets. The development of dyeing and finishing technologies would also help manufacturers add innovative coloration and finishing effects to common fabrics.

Strengths and Opportunities

13.6 Over the years, the ITF has supported many projects in textile and clothing technologies. Local universities and the HKPC have developed R&D strengths in different areas including -

(a) materials technologies such as nano-materials and related processing technologies, and smart and intelligent textile materials and garments;

(b) dyeing and finishing technologies such as new coloration and finishing technologies, electrolytic indigo dye reduction system and plasma surface treatment system; and

(c) garment technologies including the world's first sweating fabric mannequin "Walter" for evaluating the functional performance of garments. Other projects include 3D laser scanner, computer-aided garment pattern design system, e-manufacturing system, and flexible manufacturing system that aims to help manufacturers upgrade their production quality and capability.

13.7 The global market for high quality garment products is expected to grow. Therefore, there will likely be an increasing demand of functional garments, and innovative and smart textile materials such as nano-fabrics/garments.

Risks and Weaknesses

13.8 The quota system will be abolished in 2005. Local textile and clothing manufacturers need to re-position themselves and explore new niche markets. With regard to technical competence, Hong Kong is not strong in fabric technologies and lags behind the US and Europe in 3D fabric design/simulation and innovative fabric evaluation.

R&D Centre

13.9 In the preliminary consultation process, the local textile and clothing industry supported the establishment of an R&D Centre in this area. The industry suggested that apart from R&D activities, the Centre should also carry out industry support measures such as promotional and publicity activities, information exchange and provision of training. Potential R&D topics include -

(a) materials technologies for developing functional textile materials for high-end fabrics/clothing, such as nano-materials and related processing technologies, smart and intelligent textile materials, and novel yarn production;

(b) fabric technologies for developing sophisticated and fashionable fabrics, such as 3D fabric design and simulation system, and innovative fabric evaluation;

(c) dyeing and finishing technologies for enhancing yarns/fabrics coloration, surface treatment and finishing, such as innovative garment washing, new coloration and finishing technologies; and

(d) garment technologies for devising efficient production system for garment and high value-added products, such as intelligent and line-balancing optimization system, automated apparel inspection system and garment fit technology.

Annex C

Expressions of Interest in Hosting R&D Centres

Checklist for Preliminary Proposals

Interested parties are invited to provide preliminary proposals with the following information in relation to the hosting of an R&D Centre –

(a) host institution of the R&D Centre;

(b) roadmap of the technology development of the focus area, including the long, medium and short-term goal and possible projects to be undertaken;

(c) commitment of the host institution towards the operation of the Centre;

(d) mode of cooperation with other institutions and the industry;

(e) amount of funding required to set up and operate the Centre for the initial years;

(f) mode of operation of the R&D Centre, including the management and corporate governance of the Centre;

(g) expected deliverables and benefits of the projects;

(h) industry commitment in the projects and potential industry partners; and

(i) any other information which may help the Government to consider the establishment of an R&D Centre under a particular focus area.