

**For discussion
on 20 April 2021**

**Legislative Council
Panel on Commerce and Industry**

**Latest Progress of Innovation and Technology Fund and
Funding Injection Proposal**

PURPOSE

This paper briefs Members on the latest progress and enhancement measures of various funding schemes under the Innovation and Technology Fund (“ITF”) and seeks Members’ support for the injection of \$9.5 billion into ITF to continue its operation.

BACKGROUND AND LATEST PROGRESS OF ITF

Establishment of ITF

2. ITF was established by a Resolution passed by the Legislative Council (“LegCo”) on 30 June 1999 as a statutory fund under section 29 of the Public Finance Ordinance (Cap. 2) and is administered by the Innovation and Technology Commission (“ITC”). ITF has all along financed projects that contribute to innovation and technology (“I&T”) upgrading in our manufacturing and service industries, in order to facilitate the long-term development of Hong Kong.

3. The Finance Committee (“FC”) of the LegCo approved an injection of \$5 billion for the establishment of ITF in July 1999. Subsequent injections of \$5 billion and \$10 billion into ITF were approved in February 2015 and July 2018 respectively to sustain the continuous operation of the various funding schemes under ITF¹.

¹ The LegCo FC has also approved the following injections into ITF to provide dedicated funds for the implementation of relevant schemes:

- (a) In June 2016, \$2 billion was injected to fund projects under the Midstream Research Programme for Universities (“MRP”) with the investment income generated;
- (b) In July 2016, \$2 billion was injected to fund the Innovation and Technology Venture Fund (“ITVF”); In July 2018, \$10 billion was injected to fund the establishment of the *InnoHK* research clusters in Hong Kong; and
- (c) In May 2020, \$2 billion was injected to provide financial assistance in the Re-industrialisation Funding Scheme (“RFS”).

4. Supporting the development of I&T is a priority focus of the current-term Government. Our efforts in recent years have gradually achieved results. Hong Kong's gross expenditure on research and development ("GERD") has continually been on the rise, from \$16.7 billion in 2014 to \$26.3 billion in 2019, representing an increase of 57%. The number of research and development ("R&D") personnel and the number of staff members of start-ups also recorded significant increase in recent years, from an average of about 75 R&D personnel per 10 000 labour force in 2014 to about 90 in 2019, with a total number of about 36 000 R&D personnel as of now. The number of staff members of start-ups also increased significantly from about 2 400 in 2014 to about 12 500 in 2019.

5. There are currently eight unicorns in Hong Kong and the number of start-ups also increased from about 1 070 in 2014 to about 3 360 in 2020, demonstrating the growing vibrancy of our technopreneurial ecosystem. In terms of international ranking, Hong Kong is among the best, with its overall digital competitiveness² ranked 5th in the world; as for the performance in technological infrastructure³ and the Global Innovation Index⁴, Hong Kong is ranked 7th and 11th respectively.

6. The annual expenditure of ITF/ITF increased by over seven times from over \$700 million in 2013-14 to over \$5.3 billion in 2020-21. At present, ITF supports 17 funding schemes and provides funding for the work of 53 R&D centres/laboratories, in order to provide comprehensive support to local I&T force. The latest progress of various funding schemes and the operation of the relevant R&D laboratories are set out in paragraphs 7 to 15 below.

Latest Progress of Various Funding Schemes under ITF

7. ITF has started with four funding schemes and then evolved into the 17 funding schemes as of present in response to the changes in Hong Kong's I&T ecology and other developments (such as the deepening of the I&T cooperation between Hong Kong and the Mainland). Each of the 17 funding schemes has its own objective, scope, and modus operandi, supporting five I&T areas, namely

² Source: World Digital Competitiveness Ranking 2020, International Institute for Management Development

³ Source: World Competitiveness Yearbook 2020 (technological infrastructure), International Institute for Management Development

⁴ Source: Global Innovation Index 2020, Cornell University, INSEAD, World Intellectual Property Organisation

supporting R&D, facilitating technology adoption, nurturing I&T talent, supporting technology start-ups, and fostering an I&T culture. Information on the numbers of applications, the amounts of approved funding and the effectiveness of various funding schemes, etc., is set out below -

Supporting R&D

- (a) Innovation and Technology Support Programme (“ITSP”) funds applied R&D projects undertaken by local R&D Centres⁵, universities as well as other designated public research institutes⁶. In the past four years⁷, a total of 717 projects were funded with an aggregate funding amount of over \$2.8 billion. These funded projects involve different technology areas, including biotechnology, Chinese medicines, electrical and electronics, environmental technology, information technology, manufacturing technology, materials science and nanotechnology. During the same period, the funded projects have generated over 300 intellectual property (“IP”) rights⁸.
- (b) Mainland-Hong Kong Joint Funding Scheme (“MHKJFS”) was introduced in April 2019 to support and encourage universities and research institutes in Hong Kong and the Mainland to conduct collaborative R&D projects, with a view to enhancing R&D collaboration between the two places. In 2019, MHKJFS invited proposals under the themes of “Biotechnology” and “Artificial Intelligence” (“AI”). 113 applications were received by the deadline in July 2019. In 2020, proposals were invited under the themes of “Biotechnology: Research on Prevention and Treatment of Neurological Diseases; Research on

⁵ Namely the Hong Kong Applied Science and Technology Research Institute (“ASTRI”), Nano and Advanced Materials Institute (“NAMI”), Logistics and Supply Chain Multitech R&D Centre (“LSCM”), Hong Kong Research Institute of Textiles and Apparel (“HKRITA”), and Automotive Platforms and Application Systems R&D Centre (“APAS”).

⁶ Including all local self-financing degree-awarding institutions registered under the Post-Secondary Colleges Ordinance (Cap. 320), the Hong Kong Productivity Council (“HKPC”), the Vocational Training Council (“VTC”), the Clothing Industry Training Authority and the Hong Kong Institute of Biotechnology (“HKIB”).

⁷ Unless otherwise specified, “in the past four year” in this paper refers to the period between April 2017 and end February 2021.

⁸ Since 2017, funded organisations have been invited to provide relevant information about IP rights in the post-project evaluation forms submitted after completion of the projects. As some organisations have yet to submit the evaluation forms, the information has not fully reflected the total number of IP rights generated by all funded projects since 2017.

Prevention and Treatment of Cancer; and Research on Modernisation of Chinese Medicine” and “AI”. 84 applications were received by the application deadline in mid-June 2020. As at end-February 2021, eight projects which are supported by both sides have completed the entire approval process. The approval process of another four projects are expected to be completed gradually by the first half of 2021⁹.

- (c) Guangdong - Hong Kong Technology Cooperation Funding Scheme (“TCFS”) was introduced in 2004 to fund applied R&D projects that include elements of cooperation between Guangdong and Hong Kong (i.e. projects involving collaboration between research institutes and/or enterprises in Guangdong/Shenzhen and Hong Kong) to enhance R&D collaboration between Hong Kong and Guangdong Province. In the past four years, a total of 58 projects were funded, with a total funding amount of about \$90.78 million.
- (d) Partnership Research Programme (“PRP”) was launched in January 2019 by consolidating the previous University-Industry Collaboration Programme and the collaborative stream of ITSP to fund collaborative R&D projects jointly conducted by R&D Centres, universities and other designated public research institutes with companies. As at end-February 2021, a total of 107 projects were funded with an aggregate funding amount of about \$227.28 million. The funded enterprises can own the IP rights of the project and commercialise the R&D outcomes if it sponsors 50% or more of the project cost. PRP has attracted more than \$200 million sponsorship from the private market so far, illustrating the growing active participation of the industries in collaborative R&D projects.
- (e) Enterprise Support Scheme (“ESS”) was launched in 2015, to provide dollar-for-dollar matching funding of up to \$10 million for private companies to carry out in-house R&D projects. In the past four years, the ESS Assessment Panel has assessed

⁹ Applications received under MHKJFS will be first assessed by the Ministry of Science and Technology (“MOST”) and ITC separately. Only those supported by both sides will be processed. Since MHKJFS was first launched and due to the epidemic, a longer time was required for both sides to separately assess the 113 applications and subsequently compare the assessment result and then discuss and finalise the list of applications to be supported. After both sides agreed on the list of supported applications, ITC would request the applicants concerned to revise their project proposals with reference to the assessment comments, so as to facilitate the formal approval procedures.

385 applications¹⁰, of which 134 have received support. Private companies have contributed about \$445 million while ITF about \$402 million.

Among the ESS funded projects, the R&D work of 75 projects has been completed, of which 26 completed for over 24 months. We conducted a survey with the relevant companies earlier on about the progress of commercialising the project deliverables. 17 companies responded and 16 of them (17 projects involved) indicated that they had already commercialised the project deliverables with income generated. Among the 17 projects, nine received new fund injection with the total amount exceeding \$115 million. In addition, the projects also created nearly 100 additional jobs, won 40 awards and filed a total of 56 patent applications.

- (f) R&D Cash Rebate Scheme (“CRS”) was introduced in 2010 to provide cash rebate of private companies’ eligible expenditure in R&D projects funded by ITF, and those funded entirely by themselves conducted in partnership with designated local public research institutes¹¹. The level of cash rebate was 10% in 2010. It was subsequently increased to 30% in 2012 and to 40% in 2016. In the past four years, a total of about 600 companies were approved with cash rebate¹², involving a total amount of over \$500 million. We estimated that during the same period the private sector invested more than \$1.3 billion in R&D projects.
- (g) Midstream Research Programme for Universities (“MRP”) was launched in 2016 to support universities funded by the University Grants Committee (“UGC”) to conduct midstream researches. The theme for the first two rounds of MRP was “Elderly Health and Care” whereas that for the third round was “Health Technologies for Diagnosis”. As at end-February 2021, a total of 44 projects involving about \$230 million have been funded, of which 30 are R&D projects involving collaboration among multiple research institutes or

¹⁰ Under the Scheme, the amount of approved funding and number of approved projects in 2020-21 have increased by about 2.3 times and 3 times respectively when compared to 2015-16.

¹¹ Including R&D Centres established by the Government, HKPC, VTC and HKIB.

¹² Under CRS, the amount of approved funding and number of approved projects in 2020-21 have increased by about 2.5 times and about 1.3 times respectively when compared to 2015-16.

disciplines. The themes for the fourth round were “Drug Development” and “Green Engineering Technologies”. By the deadline of 26 March 2021, a total of 71 applications have been received.

Facilitating Technology Adoption

- (h) Public Sector Trial Scheme (“PSTS”) was introduced in 2011 to support public sector organisations to try out new technologies or products developed from ITF-funded R&D projects and by incubatees/graduate tenants of the Hong Kong Science and Technology Parks Corporation (“HKSTPC”) and the Cyberport with a view to helping relevant enterprises/organisations apply local R&D outcomes to local use and enhance the prospects of realisation and commercialisation.

To assist more local technology companies in realising and commercialising their R&D outcomes and encourage public organisations to utilise more local R&D outcomes, we have extended the funding scope of the PSTS to cover all technology companies conducting R&D activities in Hong Kong since 30 March 2020 to support them to produce prototypes or samples of their R&D outcomes and/or conduct trials in the public sector for improving their products. The maximum funding amount for each project is \$1 million.

In the past four years, PSTS funded 205 projects¹³ involving a total funding amount of about \$424 million, benefiting over 130 different organisations to conduct over 280 trials.

- (i) Technology Voucher Programme (“TVP”) was launched in November 2016 on a pilot basis, with an aim of subsidising local enterprises and organisations in using technological services and solutions to improve productivity, or upgrade or transform their business processes. Subsequently, TVP has been incorporated into ITF as a regular funding scheme, and a number of enhancements have been introduced.

To encourage local enterprises/organisations in using technological solutions to improve productivity and

¹³ Under PSTS, the amount of approved funding and number of approved projects in 2020-21 have increased by about 2.6 times and about 3.2 times respectively when compared to 2015-16. The funding amount and number of approved applications for 2020-21 include those under the special call for projects for the prevention and control of Novel Coronavirus Disease 2019 (COVID-19).

competitiveness, with effect from 1 April 2020, TVP has been further enhanced, with the Government funding ratio raised from two-thirds to three-quarters. The cumulative funding ceiling and the maximum number of projects funded were also increased from \$400,000 and four projects to \$600,000 and six projects.

As at end-February 2021, a total of 9 562 applications have been received under TVP (excluding applications which were subsequently withdrawn or unable to be processed due to ineligibility or missing supporting documents.) Of the 3 854 applications assessed as of end-February 2021, 3 623 were approved involving a total funding amount of about \$562 million, representing a success rate of about 94%. We estimated that the private sector entities and organisations contributed \$367 million during the same period, which indicates their efforts in digital transformation and upgrading and transforming their business processes¹⁴.

According to the evaluation reports submitted by nearly 800 beneficiary enterprises/organisations that have already completed their projects, 97% of them were of the view that the projects were conducive to enhancing their competitiveness (the remaining 3% indicated that the projects were implemented mainly to enhance efficiency or save cost rather than to increase profits). Almost all of them indicated that ITC should continue to implement TVP.

- (j) RFS was launched in July 2020 to subsidise manufacturers, on a 1 (Government): 2 (company) matching basis, to set up new smart production lines in Hong Kong. The funding ceiling is one-third of the total project cost or \$15 million, whichever is lower. The response of the industries to RFS has been positive since its launch. As at end-March 2021, the Secretariat has received 13 applications. The RFS Vetting Committee has vetted 11 applications, and agreed in principle to support nine of them, which involve industries such as biotechnology, food processing, construction, printing, medical device and nanofiber materials. It is estimated that private companies will contribute about \$110 million and ITF around \$55 million. As at end-March 2021, a total of about 230 enquires have been received under RFS. ITC will

¹⁴ Under TVP, the amount of approved funding and number of approved projects in 2020-21 have increased by about 6 times and about 5 times respectively when comparing to 2017-18.

continue to promote RFS to Hong Kong manufacturers by organising briefings in collaboration with chambers of commerce and industry associations.

Nurturing I&T Talents

- (k) Research Talent Hub (“RTH”) was introduced in July 2020 (merging the Researcher Programme (“RP”) launched in 2004 and Postdoctoral Hub (“PH”) launched in 2018). It provides funding support for eligible companies or organisations¹⁵ to engage up to four graduates in Science, Technology, Engineering and Mathematics (“STEM”)-related disciplines from a local university or a well-recognised non-local institution¹⁶ to conduct R&D work. It provides maximum monthly allowances of \$18,000, \$21,000 or \$32,000 for each research talent with a bachelor’s, master’s or doctoral degree respectively. The maximum engagement period for each research talent is generally 36 months.

In order to allow more flexibility for employers to engage R&D talents, the eligibility for RTH has been extended since March 2021, allowing employers to engage graduates with a bachelor’s or master’s degree of well-recognised non-local institutions. All participants must be Hong Kong permanent residents or persons permitted to work in Hong Kong by the Immigration Department.

In the past four years, RTH (including RP and PH) approved about 4 500 applications for research talent¹⁷ involving a total funding amount of about \$2 billion. Among these applications, there are over 1 500 applications for postdoctoral research talent, involving a funding amount of about \$930 million. ITC has been inviting funded research talents to submit evaluation questionnaires after the end of their engagement periods. According to the 507 questionnaires

¹⁵ All technology companies conducting R&D activities in Hong Kong, including incubatees and I&T tenants of the HKSTPC and the Hong Kong Cyberport Management Company Limited, as well as organisations and companies undertaking R&D projects funded by ITF, are eligible to apply.

¹⁶ “Well-recognised non-local institution” refers to one of the top 100 institutions for STEM-related subjects in the latest Quacquarelli Symonds World University Rankings, the Academic Ranking of World Universities and the Times Higher Education World University Rankings.

¹⁷ Under RTH, the amount of approved funding and number of approved projects in 2020-21 have increased by about 7 times and about 3.5 times respectively when comparing to 2015-16.

collected in 2020, more than 95% of the research talents who have completed RTH expressed interest in pursuing a career in scientific research in the future; about 63% indicated that they had secured a job in R&D-related areas, while 26% expressed that they were still searching for jobs or had decided to further their studies.

- (l) Reindustrialisation and Technology Training Programme (RTTP) was introduced in 2018 to fund local enterprises on a 2(Government):1(enterprise) matching basis for their staff to receive training in advanced technologies, especially those related to “Industry 4.0”. RTTP is administered by the Vocational Training Council (“VTC”) and overseen by VTC’s Innovation and Technology Training Board, which determines the types of technology training that can be funded. As at end-February 2021, RTTP has approved 1 116 applications for registering public courses and funding of over \$29 million for 3 740 trainees to receive over 4 640 trainings in advanced technologies.
- (m) STEM Internship Scheme was launched in June 2020 as a pilot scheme to subsidise undergraduates and post-graduates taking STEM related programmes in local universities¹⁸ to enrol in short-term internships, with a view to encouraging STEM students to gain I&T-related work experience during their studies and to fostering their interest early in pursuing a career in I&T after graduation, so as to enlarge the local I&T talent pool (see paragraphs 24 - 25 below). In 2020 summer and winter, more than 1 600 students and over 1 000 companies/organisations participated in the scheme, with expenditure of about \$37 million.

Supporting Technology Start-ups

- (n) Technology Start-up Support Scheme for Universities (“TSSSU”) was launched in 2014 to support professors and students of six universities (i.e. the University of Hong Kong, the Chinese University of Hong Kong, City University of Hong Kong, the Hong Kong University of Science and Technology, Hong Kong Baptist University and the Hong Kong Polytechnic

¹⁸ The seven universities are the University of Hong Kong, the Chinese University of Hong Kong, City University of Hong Kong, the Hong Kong University of Science and Technology, Baptist University of Hong Kong, the Hong Kong Education University and the Hong Kong Polytechnic University.

University) to start technology businesses and commercialise their R&D results. Starting from 2019-20, the maximum annual funding per university under TSSSU has doubled from \$4 million to \$8 million, and the maximum amount of financial assistance for each start-up has increased from \$1.2 million to \$1.5 million per year. In the past four years, TSSSU has provided a total of about \$143 million to 200 start-ups.

Funded start-ups have to submit an annual report on the development of their businesses to ITC via their associated universities. During 2017-18 to 2019-20, out of the 156 funded start-ups, 36 won international awards, 83 generated a total of more than 550 IP rights from their R&D results, 98 rolled out a total of about 200 products or services in the market, and 80 generated business revenue. In addition, 123 start-ups have successfully received capital injections. The total investment was nearly \$400 million, of which over \$250 million (around 64%) was private investment.

- (o) ITVF was launched in 2017. It aims to encourage venture capital (“VC”) investment in local I&T start-ups so as to create a more vibrant start-up ecosystem in Hong Kong. In the third quarter of 2018, ITC entered into agreements with six VC funds, under which the Government will co-invest with co-investment partners (“CPs”) in local I&T start-ups at a matching investment ratio of approximately 1 (Government):2 (CPs).

After a round of open application and selection process, ITC has selected a batch of VC funds as CPs and entered into agreements with three of them in December 2020 with a view to investing in more local I&T start-ups.

As at February 2021, the Government, through ITVF, invested more than \$100 million in 19 local I&T start-ups with businesses covering supply chain management, e-commerce, financial technology, biotechnology and AI, etc., attracting private investment of over \$500 million.

Promoting I&T Culture

- (p) General Support Programme (“GSP”) was introduced in 1999 to support non-R&D projects that help upgrade local industries and promote I&T culture in Hong Kong. In the past four years, GSP funded 100 projects with a total funding amount of about \$185 million. Examples of funded events in 2020

include the “Gerontech and Innovation Expo cum Summit” (with attendance of over 23 000), the “Hong Kong Student Science Project Competition” (with about 530 secondary school students participating), the “Hong Kong University Student Innovation and Entrepreneurship Competition” (with about 515 university students participating), and the “Innovation and Technology Scholarship” (with awards given to 25 university students). These activities help foster knowledge and interest in I&T amongst the general public, especially youngsters. GSP also supports projects which promote the development of smart city in Hong Kong, such as organising smart city pavilions and thematic seminars to introduce smart city technology and its application as well as providing platforms for exchanges among the local industries.

- (q) Patent Application Grant (“PAG”) was launched in 1998 to provide funding support for first-time patent applicants. In the past four years, a total of 582 applications were approved with a total funding amount of about \$150 million. Over 443 applicants have been granted patents during the same period.

8. Since its introduction two decades ago, ITF has made significant contributions to the local I&T development by nurturing numerous R&D talent and start-ups, delivering commercialised R&D results, as well as attracting private investment of over \$4 billion. These are elements essential in a vibrant I&T ecosystem, laying a solid foundation for Hong Kong’s development into an international I&T hub as supported under the 14th Five-Year Plan. At the same time, ITF brings about benefits to the daily life of the general public (especially during the COVID-19 pandemic), as well as the commercial and industrial sectors. Examples of signature projects under ITF are set out at **Annex I**.

R&D Centres, Technology Transfer Offices of Universities (“TTOs”) and Laboratories

9. In addition to funding schemes, ITF funds, in full or in part, the operating expenditure of R&D Centres, TTOs and laboratories to enable them to carry out more R&D work and technology transfer, or commercialise their R&D outcomes. The entities supported include -

- (a) the 16 State Key Laboratories (“SKLs”) in Hong Kong;
- (b) the six Hong Kong Branches of the Chinese National Engineering Research Centres (“CNERCs”);
- (c) the research centres/laboratories in the InnoHK research clusters;
- (d) four R&D centres (i.e. NAMI, LSCM, HKRITA, and APAS)¹⁹; and
- (e) the TTOs of seven universities²⁰.

SKLs and Hong Kong Branches of the CNERCs

10. The SKL Scheme is one of the major national science and technology development schemes managed by the Ministry of Science and Technology (“MOST”). High-quality research teams and good research equipment are prerequisites for becoming SKLs. Meanwhile, research institutions approved by MOST as CNERCs serve as major impetus in providing engineering research and consultancy support to the industries. They need to possess strong R&D capabilities and enjoy leading positions in their areas of expertise both in the Mainland and internationally. Currently, there are a total of 16 SKLs and six Hong Kong Branches of CNERCs (see **Annex II**) in Hong Kong. Examples of their R&D results in recent years are also set out at **Annex II**.

11. Since the financial year 2011-12, ITC has been providing annual funding to SKLs in Hong Kong and the Hong Kong Branches of CNERCs as a source of funding in addition to funding approved by the University Grants Committee as well as various local and Mainland institutions, to enable them to strengthen their research capability, build up the necessary infrastructural support and map out a longer term development plan. At present, the maximum annual funding for each of them is \$10 million, and the funding scope covers manpower, equipment, consumables and services incurred for the purpose of conducting R&D work.

¹⁹ The operating expenditure of ASTRI is met separately by Government’s annual recurrent funding.

²⁰ The seven universities are the University of Hong Kong, the Chinese University of Hong Kong, City University of Hong Kong, the Hong Kong University of Science and Technology, the Hong Kong Baptist University, the Hong Kong Education University and the Hong Kong Polytechnic University.

“InnoHK” Research Clusters

12. We are pressing ahead with the establishment of the *InnoHK* Research Clusters in the Hong Kong Science Park. The first two research clusters are “*Health@InnoHK*” focusing on healthcare technologies and “*AIR@InnoHK*” focusing on AI and robotics technologies. The *InnoHK* Research Clusters have received over 60 proposals from local universities and many world-renowned universities and research institutes. After rigorous selection and assessment process, the first batch of around 20 admitted R&D centres have completed the renovation of their laboratories and commenced operation progressively. It is estimated that the remaining some seven R&D centres will commence operation later this year.

13. The research areas of “*Health@InnoHK*” cover drug discovery, personalised medicine, molecular diagnostics, bioengineering, chemical biology, bioinformatics, vaccine development and medical instrumentation etc. The research areas of “*AIR@InnoHK*” cover big data analysis, machine learning, medical robotics, mobile robots and construction robots etc. The R&D Centres under the two research clusters are actively recruiting postgraduates and R&D personnel. The work progress of some R&D centres is affected by the epidemic. We are closely monitoring the related development and will announce the list of admitted R&D centres in due course.

R&D Centres

14. Since 2006, the Government has set up five R&D Centres to drive and coordinate applied R&D in relevant areas. The R&D Centres work closely with the industries to encourage local private enterprises to invest in R&D so as to facilitate the commercialisation of R&D results and technology transfer. The R&D Centres also actively participate in PSTS to promote the use of local technology products and services by public sector organisations. Over the years, the R&D Centres have nurtured a group of scientific research talent, and their innovative inventions have also won international awards. We will brief the Panel on the progress report of the R&D Centres in June 2021.

TTOs

15. ITC has been providing extra funding through ITF to TTOs of seven universities, in addition to UGC, with a view to enhancing their technology transfer capabilities, and supporting the development of innovative ideas and R&D results of universities’ scientific research talent into new products or services. The funding support has facilitated the

patent and licensing activities in TTOs, enabled TTOs to organise various activities for promoting entrepreneurship and proactively connect with industry players, investors, public and private incubators/accelerators, as well as the local, Mainland and overseas R&D communities. All these efforts have provided pertinent assistance to technology start-ups incubated by the universities. The universities have procured more professional services and engaged more professionals of related areas to assist in optimising the application and management of patents, expanding their networks in the industry, and implementing business plans, etc. The number of patents granted to the universities receiving the funding support have increased from 319 in 2014-15 to 640 in 2019-20. Meanwhile, the number of patent licensing agreements have increased from 333 to 557. In addition, TTOs have delivered 2 686 technology transfer-related public lectures, symposium and exhibitions, etc., and organised/attended 447 promotional, marketing and business development activities, etc.

Benefits brought by ITF to I&T Development

16. ITC has all along monitored the implementation of various ITF funding schemes and the work progress of funded organisations/projects to ensure the proper use of public money. To examine the impact of individual funding schemes under ITF, ITC has recently commissioned an independent consultant to carry out a study of five schemes under ITF, namely ESS, ITSP, TCFS, RP and GSP. The consultant has engaged over 800 ITF stakeholders through interviews, focus group discussions and survey.

17. According to the consultancy report, ITF has made significant contributions in advancing I&T development, facilitating commercialisation of R&D outcomes, creating economic impact and nurturing R&D talents. According to the estimates of the consultant, outcomes of ESS, ITSP and TCFS in the above areas are tabulated below:

Completed and Ongoing Projects	ESS	ITSP	TCFS
Percentage of projects with commercialisation income*	53%	33%	18%
Cumulative commercialisation income*	HK\$378 million	HK\$3,742 million	HK\$248 million
Percentage of projects with patents granted	44%	31%	56%

Completed and Ongoing Projects	ESS	ITSP	TCFS
Percentage of projects with start-up/spin-off company established	29%	15%	21%
<i>Fostering knowledge/technology transfer and sharing</i>			
Percentage of projects published in academic/professional publications	17%	39%	59%
Percentage of projects granted science and technology/industry awards	34%	29%	34%
Number of knowledge sharing activities organised	1 392 activities	22 885 activities	3 180 activities
Percentage of project coordinators who indicated if not for ITF funding, the project could not have been conducted	96%	90%	87%

* It is worth noting that ITSP and TCFS projects are mainly seed and platform projects that belong to relatively upstream (exploratory in nature) and midstream R&D, which are far from the commercialisation phase and the above outcomes are not easy to achieve.

18. These schemes have engaged a cumulative total of 25 238 R&D talents and the results are encouraging. Some of the completed projects were also able to attract further investment from private market funds (including angel investors and venture capital), which demonstrates that relevant schemes were able to foster co-investment of public and private sectors in R&D, thereby increasing Hong Kong's overall gross expenditure on R&D. Separately, TCFS has established a sound foundation for Guangdong-Hong Kong and Shenzhen-Hong Kong R&D collaboration. As TCFS proceeds, the interest from both sides to collaborate on R&D projects grows, which helps foster cross-border exchange and collaborative development.

19. The consultant has also interviewed project coordinators of RP and GSP, with results as follows –

Schemes	Interview results
RP	<ul style="list-style-type: none"> • 84% of project coordinators indicated RP assisted them in recruiting an adequate number of R&D talents • Of the researchers recruited under RP, 83% continued to develop in the I&T sector, within which 41% remained in the same organisation
GSP	<ul style="list-style-type: none"> • 93% of funded organisations indicated that ITF funding was indispensable • 92% of funded organisations indicated that GSP was effective in enhancing public knowledge and interest in I&T and building an I&T culture • 84% of the funded organisations intended to continue organising non-R&D projects that would foster I&T development

20. According to survey findings, the most important positive impact brought about by ITF within and beyond the organisations of project coordinators of the five funding schemes are set out in the below table –

Funding Schemes	Most important positive impact within the organisation	Most important positive impact beyond the organisation
ESS	Development of new/improved products or services	Project results can contribute to advancements in technology and innovation areas
ITSP	Knowledge accumulation on specific innovation/technology/research area	Project results can contribute to advancements in technology and innovation areas
TCFS	Increased research capacity and additional R&D projects	Foster collaboration with Mainland institutes and organisations
RP	Increased research capacity and reputation of the organisation	Nurture more R&D talents
GSP	Increased recognition	Enhance public awareness of

Funding Schemes	Most important positive impact within the organisation	Most important positive impact beyond the organisation
	and prestige	I&T and build an I&T culture in the community

ENHANCEMENT MEASURES

21. To match the pace of social and economic developments, we will continue to make the best use of ITF to provide support in different areas in order to inject impetus into the future development of the local I&T ecosystem. We will continue to review the operation of ITF from time to time to improve its efficiency and flexibility. In the coming year, we plan to implement the enhancement measures and new measures as set out in paragraphs 22-30 below.

Engaging Hong Kong Productivity Council (HKPC) as Implementation Partner of TVP

22. TVP is very popular with the local business sector, and the number of applications received has been increasing substantially and persistently. Excluding applications which were subsequently withdrawn or were unable to be processed due to ineligibility or missing supporting documents, the numbers of applications in the past few years are as follows:

Year	Number of Applications
2016 (November – December)	15
2017	577
2018	703
2019	1 574
2020	5 795
2021 (as at end-February 2021)	898

23. To expedite the processing of applications received, ITC, after considering the operation of TVP and making reference to the experiences of other funding schemes²¹, decides to engage HKPC as the

²¹ At present, RTTP and PAG under ITF also adopt similar arrangements, i.e. appointing VTC and HKPC as secretariat and implementation agent respectively.

implementation partner²², and utilise its professional experience to improve efficiency as well as shorten the processing time.

Regularise STEM Internship Scheme

24. Last year, the Government earmarked \$40 million under ITF to launch the STEM Internship Scheme on a pilot basis to provide a monthly allowance of \$10,500 to undergraduates and post-graduates taking STEM related programmes in local universities to enrol in short-term I&T-related internships. The seven participating universities commented that the Scheme had encouraged employers to create more I&T-related internship places, offering students the opportunity to apply their STEM knowledge in the workplace and understand the I&T work environment and culture early. According to the findings of the surveys conducted by participating universities, upon completion of their internship, most of the students (94%) gained a better understanding of the I&T field, and 88% of students would consider pursuing a career in I&T in the future. A vast majority of the participating employers (99%) were satisfied with the interns' performance and 96% of the employers planned to join the scheme again. In view of the universities' and the business sector's overwhelming response and high regard for the scheme, the Financial Secretary announced in the 2021-22 Budget that the STEM Internship Scheme would be regularised.

25. The regularised scheme generally adopts the arrangements of the pilot phase, with its expenditure subsumed under ITF. On eligibility, having liaised with the universities, we have included more STEM-related programmes in the list of eligible programmes of the scheme.

Expanding the Funding Scope of RTH

26. The Chief Executive announced in the 2020 Policy Address that the Government would launch a Global STEM Professorship Scheme²³ to attract more world-renowned scholars to engage in I&T-related teaching and research activities in Hong Kong. The Innovation and Technology Bureau ("ITB") is working with the Education Bureau to formulate the details of the scheme. We will provide around \$500 million under RTH of ITF for scholars to recruit up

²² Administrative costs involved in the implementation of TVP by HKPC will mainly be covered by ITF. HKPC, as implementation partner of TVP, will also bear part of the administrative costs including office expenses and salaries of some of the staff.

²³ The Government briefed the LegCo Commerce and Industry Panel on the Global STEM Professorship Scheme on 26 January 2021.

to four researchers to assist them in carrying out R&D work for three years. The level of monthly subsidy will be on a par with that of RTH, with a current funding level of a maximum of \$32,000 per month for doctoral degree holders.

PROPOSED NEW MEASURES

Subsuming MRP under ITSP

27. At present, both ITSP and MRP provide funding support to R&D projects in various technology areas. The former is a block vote project under ITF with an aim of supporting midstream/downstream R&D projects conducted by local R&D centres, universities and other designated local public research institutes. The latter is a block vote item with a dedicated provision of \$2 billion of capital which supports, with its interest income generated, theme-based midstream R&D projects conducted by UGC-funded universities. To improve the flexibility in utilising the funding, we propose to subsume MRP under ITSP which will continue to support midstream R&D projects.

Incorporating the funds of RFS and the Innovation and Technology Fund for Better Living (“FBL”) into ITF Block Vote

28. In June 2016, the FC approved the creation of a new commitment of \$500 million by ITB for the establishment of the FBL to support I&T projects that aim to make the daily life of the public more convenient, more comfortable and safer or address the needs of specific groups. FBL was launched in 2017. In the past four years, FBL funded 35 projects involving a funding amount of about \$118 million and the remaining commitment is about \$380 million.

29. On the other hand, the FC approved in May 2020 an injection of \$2 billion into ITF to create a dedicated subhead with a \$2 billion commitment for the implementation of RFS to subsidise manufacturers to set up new smart production lines in Hong Kong on a 1 (the Government) : 2 (company) matching basis.

30. Having reviewed in detail the modus operandi and spending patterns of the two schemes, we propose to merge the two schemes with ITF with a view to utilising the funding more flexibly. If the proposal is eventually adopted, the funding arrangements of the two schemes will be consistent with other funding schemes currently under ITF. This will increase the flexibility of utilising ITF funds, better meet market needs and more effectively ensure the long-term operation of the two schemes.

FUNDING PROPOSAL

31. As mentioned in paragraph 3 of this paper, the FC has so far approved an allocation of \$20 billion in total to ITF and the total income of ITF to date is about \$6.8 billion (derived mainly from investment income from the Exchange Fund). Since its establishment in 1999, more than 19 800 projects have been funded by ITF as at end-February 2021, involving a total commitment of around \$22.7 billion. As at end February 2021, the uncommitted balance of ITF was \$4.1 billion.

32. The expenditure of ITF has increased substantially in recent years with the launch of various new funding schemes and enhancement measures. It is estimated that the expenditure of ITF will reach approximately \$5.3 billion and \$5.1 billion in 2020-21 and 2021-22 respectively and will be exhausted in the fourth quarter of 2021. Therefore, we need to inject \$4.75 billion into ITF in 2021-22 and 2022-23 respectively, i.e. \$9.5 billion in total, to sustain the continuous operation of the existing funding schemes as well as the introduction of new measures.

EXPECTED BENEFITS

33. The proposals to inject \$9.5 billion into ITF, and to merge MRP, RFS and FBL with ITF will –

- (a) provide sustained and comprehensive support for applied R&D activities in Hong Kong;
- (b) continue to raise the level of GERD;
- (c) encourage R&D collaboration and exchanges between universities/public research institutes and private companies, and amongst the local, overseas and Mainland research communities;
- (d) support the upgrading and development of various industries in Hong Kong through I&T activities so as to meet the changing international, Mainland and domestic business environment;
- (e) encourage more private companies to participate in ITF-funded projects or invest in R&D projects, non-R&D projects and technology start-up activities;

- (f) encourage technological application by the industries, facilitate the adoption of local R&D outcomes by public sector organisations, improve the quality of life of citizens;
- (g) create more I&T jobs and internship opportunities to nurture and attract more I&T talents;
- (h) organise I&T activities for all to foster a vibrant I&T culture;
- (i) support the local “re-industrialisation” progress;
- (j) encourage and attract more internationally renowned universities and R&D institutions to collaborate with local scientific research institutes; and
- (k) further enhance Hong Kong’s I&T ecology and help build Hong Kong into an international I&T centre.

MONITORING AND REVIEW

34. ITC has already put in place a robust control mechanism, and regularly review the operation of the various funding schemes to ensure that the funding is properly disbursed and used. We will also introduce enhancement measures in a timely manner to meet the development and needs of the society. In brief, all applications are vetted by professional panels (which generally include the industries and independent members) according to the assessment framework of the relevant funding scheme. Each scheme has its own guidelines on, among other things, the usage of ITF funding, procurement arrangements, reporting and auditing requirements, disbursement of grants and return of residual funds, etc. All such requirements, alongside key information of approved projects, are available on ITF’s website²⁴ for public reference.

35. ITC conducts progress meetings/site visits with the project teams to verify the project progress and usage of funds as set out in the project reports. Funds will be disbursed only if the project is able to meet pre-set milestones. In case of non-compliance with the funding guidelines or where project progress is unsatisfactory, we may withhold the disbursement of funds. ITC will continue to enforce the control mechanism, review and make necessary enhancements as appropriate.

²⁴ <https://www.itf.gov.hk/en/project-search/index.html>

FINANCIAL IMPLICATIONS

36. We estimate that the proposed injection of \$9.5 billion into ITF and the proposal to implement new measures (see paragraphs 27 – 32 above) will sustain the operation of ITF up to the first quarter of 2024²⁵. According to the latest forecast, the estimated expenditure under ITF is as follows -

Financial Year	2020-21	2021-22	2022-23	Total
\$ million	5,331	5,062	6,267	16,660

ADVICE SOUGHT

37. If Members support the above proposals, we will seek approval of the FC for the injection of \$9.5 billion into ITF and implement the proposed new measures mentioned above.

Innovation and Technology Bureau
Innovation and Technology Commission
April 2021

²⁵ The actual cash flow of ITF may vary depending on the number and amount of funding applications approved under different schemes, and whether there would be any new schemes in the future.

Some signature examples of the Innovation and Technology Fund

Anti-epidemic

- (a) Adopting its nanofiber technology, the Nano and Advanced Materials Institute has developed the world's first nanofiber N99 facemask – NASK, in collaboration with a manufacturer with the funding support of the Innovation and Technology Support Programme (“ITSP”). NASK is manufactured in Hong Kong and is compliant with the EN149 standard of the European Union. It is a super breathable facemask with bacteria killing property, and is effective in removing most of the airborne contaminants. NASK has also been adopted by the Hospital Authority since March last year to mitigate the global shortage of surgical respirators.
- (b) The Government has developed the “StayHomeSafe” system and electronic wristband in the early stage of the epidemic to support the mandatory home quarantine measure implemented in early February 2020. The system makes use of a Bluetooth Low Energy electronic wristband and a monitoring solution developed by the Logistics and Supply Chain Multitech R&D Centre with funding support by Innovation and Technology Support Programme (“ITSP”), coupled with the “StayHomeSafe” mobile app developed by a local technology start-up that adopts geo-fencing technology, to detect electronic signals around the dwelling places of persons under quarantine. Using artificial intelligence (“AI”), it analyses changes in various signal strength to effectively monitor whether persons under quarantine are staying at their designated premises;
- (c) In early 2020, the Novel Coronavirus Disease 2019 (“COVID-19”) started to spread rapidly, and there was an acute shortage of disposable masks in the market. We utilised the R&D results of Hong Kong Research Institute of Textiles and Apparel (“HKRITA”) which was funded by ITSP to produce CuMask+™ to help the community fight the epidemic. Two of the layers of CuMask+™ are made with small quantities of copper, capable of immobilising bacteria, common viruses, and other harmful substances. It reaches the American Society for Testing and Materials F2100 Level 1 standard, and could be reused for 60 times. It is a more environment-friendly choice. From May last year to end-February 2021, the Government has distributed around 10.48 million CuMask+™ via different channels for Hong Kong residents’ use;
- (d) ITSP has funded a multi-level antimicrobial polymer coating developed by a local university. This kind of coating is applicable

to different surfaces including metals, wood, glass, plastics as well as fabrics and textiles. It has an effective period of up to 90 days and could help enhance personal and public hygiene and safety. The R&D outcomes have been transformed into innovative products to address the urgent needs of the community during the epidemic;

- (e) The Hong Kong Productivity Council (“HKPC”) developed the “kNOw Touch” contactless elevator panel which activates elevators over-the-air to reduce the risk of virus spreading. The prototype of the “kNOw Touch” is funded by the special call for projects under Public Sector Trial Scheme (“PSTS”) for the prevention and control of the COVID-19 epidemic, and organisations participating in the trial include the Electrical and Mechanical Services Department (“EMSD”) and the Airport Authority Hong Kong, covering sites including the West Wing of the Central Government Offices, Block 2 and Block 3 of Housing Authority Headquarters and the Lung Cheung Office Block, Cheung Sha Wan Government Offices, West Kowloon Health Centre, Tai Po Hui Market and Cooked Food Centre and EMSD Headquarters. Apart from the sites in the trial, HKPC has, in collaboration with elevator contractors, installed the “kNOw Touch” system at around 50 sites including private housing estates, commercial buildings and shopping centres, etc. The installation of the system at the Legislative Council Complex has already been completed. Besides, the Housing Authority and the Housing Society plan to install the system for about 200 elevators in its housing estates through companies licensed by HKPC;
- (f) A COVID-19 testing reagent developed by a local company has been trialled in the University of Hong Kong through the funding support of the special call for projects under PSTS. This type of testing reagent can produce testing results within a short period of time and can assist medical institutions and testing laboratories to conduct rapid testing of COVID-19;

Livelihood

- (g) With the funding support of ITSP, HKRITA has developed asymmetric footwear according to biomechanical characteristics, using materials with good abrasion resistance and mechanical properties to match the requirements of fencing sports. The project has been awarded the silver award at the 45th International Exhibition of Invention of Geneva. In addition, athletes from the Hong Kong fencing team were equipped with the fencing shoes developed from the project to attend international competitions, including Rio Summer Olympic in 2016, and Hong Kong Asian Championships in 2017. In 2020, the project outcome has been licensed to a private enterprise for commercialisation;

- (h) With the funding support of ITSP, a local university has developed a novel “T1rho” imaging technology which provides artifacts-free “T1rho” imaging at the presence of magnetic field inhomogeneity. Clinical studies reported that “T1rho” is a valuable biomarker for diagnosis of a variety of diseases. However, at present, no MRI vendors in the market, including General Electric, Philips, and Siemens, provides commercial product of “T1rho”. The main reason is that the current T1rho technology is not stable enough to meet the standard clinical application requirement because the “T1rho” quantification is highly sensitive to magnetic field inhomogeneity. This novel technology can help overcome these obstacles and assist medical staff in medical diagnosis even at the presence of magnetic inhomogeneity. A “T1rho” prototype has been set up in the Prince of Wales Hospital for trial. Moreover, a start-up has been set up to commercialise this technology;
- (i) With the funding support of ITSP, a local university and the Massachusetts Institute of Technology has jointly developed AI and machine learning technologies in 2020 that can improve existing e-learning platforms. It does not only provide a variety of learning analysis and tutoring tools, but also recommends diversified learning paths to learners. The technologies have been applied to an online learning platform, allowing parents to understand their children’s learning progress in various areas, so as to formulate more accurate learning plans;
- (j) With the funding support of Guangdong-Hong Kong Technology Cooperation Funding Scheme (“TCFS”), a local university developed a special formula of medical silicone gel to be incorporated in pressure therapy for scar management. The silicone gel insert could provide optimal pressure on the scars and exert moisturising effects. The silicone gel developed has been shown to be durable, chemically and biologically inert and attachable on other surfaces such as fabrics. A pilot test on the prototypes with both normal skin and scars of volunteers has been conducted to test the pressure range, medical inertness and clinical effects. Clinical trials on patients from the Mainland and Hong Kong with different types of scars (i.e. surgical/burn/skin trauma) has also been carried out to show the clinical effectiveness of the product. This innovation won the Grand Award and a Gold Medal at the 45th International Exhibition of Inventions of Geneva, Switzerland in 2017. The relevant product has already been licensed to a company for commercialisation and is now being sold in Hong Kong;
- (k) With the funding support of TCFS, a local university has developed a quartz-enhanced photoacoustic spectroscopic system in 2018, which could be applied to urea breath test for detection of Helicobacter

pylori infection, as well as other air pollution monitoring. This system is of lower cost, portable size and can quickly generate testing results (i.e. 0.1 second). Patent of the developed technology had been filed in the United States, and it is planned to be disseminated to the medical and public health sector in the next decade;

- (l) With the funding support of Midstream Research Programme for Universities (“MRP”), a local university has developed an unobtrusive health-monitoring system combining multimodality sensing and machine learning technologies to achieve early detection of cardiovascular diseases and prevention of dementia, thereby relieving the medical burden and expenses of the society. Existing commercially available health monitoring devices cannot perform long-duration and high accuracy monitoring of vital signs for the elderly. This project will address such performance limitation by integrating novel sensor designs and the generation and processing of signals. The core technologies of this project was successfully transferred to wearable devices in 2020 and the system is now under clinical validation;
- (m) With the funding support of MRP, a local university has developed a Virtual Therapist software system that utilises machine learning, data analytics, signal processing and AI algorithms to detect signs of negative mental emotional conditions, such as depression, anxiety and dementia in elderly patients. This university has already set up a start-up which dedicates to commercialise the relevant AI technologies. In the future, the company has a high chance in utilising the relevant R&D outcomes to carry out downstream research or product development activities;
- (n) Funding was provided by PSTS under ITF to a local university to conduct a trial by developing a genome database system for the Clinical Genetic Service of the Department of Health (“DH-CGS”). Over 1 000 samples were imported into the database with clinical information. The databases and machine learning module are used for diagnosis and research by DH-CGS. This project has enhanced the capability of DH-CGS in diagnosing genetic diseases and rare-disease-causing mutations. DH expressed that the project team had developed an effective population genomic database for storing and utilizing the genomic data. All the clinical and laboratory staff are satisfied with the project deliverables, in terms of the functionalities and performance;
- (o) Funding was provided by PSTS under the ITF to a local university to develop a system using electromyography-driven neuromuscular electrical stimulation for stroke patients for rehabilitation of the whole upper limb. The system not only can provide assistance to

the elbow and wrist joints by electric motors, but also can enhance the neuroplasticity during recovery by inducing additional muscular practice at the elbow, wrist and hand/fingers through electrical stimulation. The system will encourage a user to continuously generate electromyography to maximize the involvement of voluntary efforts during training. The proposed system will be portable, light-weighted and easy-to-use in hospital or at home. The project outcomes won a Gold Medal and Special Merit Award at the 43rd International Exhibition of Inventions of Geneva in 2015. Two China patents on the innovative design of the portable and wearable training system have been granted. The preliminary results showed that the novel electrical stimulation training can better accelerate the recovery of patients' upper-limb functioning comparing with conventional training. Project deliverables have been successfully licensed to two companies for commercialisation;

Industrial and Commercial

- (p) With the funding support of TCFS, a local university has developed the core technology to improve the carbon nanotube based pulse energy and power of the ultrafast pulse mode-locked lasers, which could be used for micro-processing of high precision transparency materials, e.g. sapphire, etc., so as to enhance the manufacturing capability of high-end electronic products. Two patents of the developed technologies have been filed by the university. The project team is seeking further collaboration with the industrial partner;
- (q) With the funding support of the Partnership Research Programme, a local university has developed a “Smart Geotechnical Monitoring System” in collaboration with a local enterprise through an R&D project. The system can provide comprehensive monitoring in construction projects to keep track of movements of ground conditions, existing adjacent structures, and other possible impacts which may arise as a result of the works. The project outcome has been adopted by its project's industry partner for local engineering projects;
- (r) With the funding support of the Re-industrialisation Funding Scheme (“RFS”), a local food processing enterprise will set up a food processing smart production line for a central kitchen. Using traditional cooking processes with smart technologies such as Industrial Internet of Things and data analysis the smart production line could enhance production efficiency to tackle limited production capacity, and enhance quality control and food safety so as to explore new market development and enhance its competitiveness in the market;

- (s) With the funding support of RFS, a local technology company will set up a smart electrospinning production line for nanofiber filter material. Traditional needle-type electrospinning production line faces a number of problems like easy needle clogging which requires manual replacement of needles, no real-time monitoring system and limited collectable data, etc. The smart production line to be set up could enhance production efficiency and quality, as well as create smart production related jobs to nurture local talent with knowledge on the area;
- (t) With funding support by RFS, a local biotechnology company will set up a smart production line to produce biochips for diagnostic rapid testing. Through smart technologies like real-time data and robotic systems, the whole production process will be completed in the clean room environment thereby increasing the production capacity and at the same time reducing product contamination risk and preventing work injury of staff due to prolong working hour. The planned smart production line can enhance production efficiency and quality, and hence can raise production capability of the biochips to meet the market demand;
- (u) With the funding support of the R&D Cash Rebate Scheme (“CRS”), a local manufacturer of intelligent security systems commissioned HKPC to research and develop smart production lines. The smart production lines, which can assemble high precision parts, effectively increase the production success rate. Through the support of intelligent automation equipment and digital technology, not only is the production capacity greatly enhanced but also its space requirement is substantially reduced;
- (v) Moreover, with the funding support of CRS, a local company, with producing plastic products in the Mainland being its core business, commissioned HKPC to develop and establish an intelligent production line for manufacturing optical adaptive lenses in Hong Kong, successfully developed its high value-added product lines and supply chains. Leveraging this, the company is able to open the Mainland and European markets with its “Made in Hong Kong” products. The intelligent production line, consisting of six machines and about 30 meters long, occupies only about 3,000 square feet and requires only two people to operate with a maximum production capacity of 100 lenses per hour.

**State Key Laboratories (“SKLs”) in Hong Kong
and Hong Kong Branches of
Chinese National Engineering Research Centres (“CNERCs”)
and Examples of Research Results in Recent Years**

I. SKLs in Hong Kong

	Hosting Organisation	Name of SKL	Head	Year of Approval
1.	The University of Hong Kong	SKL of Emerging Infectious Diseases	Prof GUAN Yi Prof YUEN Kwok-yung	2005
2.	The University of Hong Kong	SKL of Brain and Cognitive Sciences	Prof Tatia LEE Mei-chun	2005
3.	The Chinese University of Hong Kong	SKL of Translational Oncology	Prof Dennis LO	2006
4.	City University of Hong Kong	SKL of Terahertz and Millimeter Waves	Prof CHAN Chi-hou	2008
5.	The Chinese University of Hong Kong	SKL of Agrobiotechnology	Prof Hon-Ming LAM	2008
6.	The Hong Kong Polytechnic University	SKL of Ultra-precision Machining Technology	Prof Benny CHEUNG	2009
7.	The Hong Kong University of Science and Technology	SKL of Molecular Neuroscience	Prof Nancy IP Yuk-yu	2009
8.	City University of Hong Kong	SKL of Marine Pollution	Prof Kenneth Mei Yee LEUNG	2009
9.	The Chinese University of Hong Kong	SKL of Research on Bioactivities and Clinical Applications of Medicinal Plants	Prof LEUNG Ping-chung	2009
10.	The University of Hong Kong	SKL of Liver Research	Prof Irene O.L. NG	2010
11.	The University of Hong Kong	SKL of Synthetic Chemistry	Prof CHE Chi-ming	2010
12.	The Hong Kong Polytechnic University	SKL of Chemical Biology and Drug Discovery	Prof WONG Kwok-yin	2010
13.	Hong Kong Baptist University	SKL of Environmental and Biological Analysis	Prof CAI Zongwei	2013
14.	The University of Hong Kong	SKL of Pharmaceutical Biotechnology	Prof XU Aimin	2013

	Hosting Organisation	Name of SKL	Head	Year of Approval
15.	The Chinese University of Hong Kong	SKL of Digestive Disease	Prof YU Jun	2013
16.	The Hong Kong University of Science and Technology	SKL of Advanced Displays and Optoelectronics Technologies	Prof Ching Wan TANG	2013

II. Hong Kong Branches of CNERCs

	Hosting Organisation	Name of Hong Kong Branch of CNERC	Head	Year of Approval
1.	Hong Kong Applied Science and Technology Research Institute	Hong Kong Branch of the National ASIC System Engineering Research Center	Dr Martin SZETO	2012
2.	The Hong Kong Polytechnic University	Hong Kong Branch of National Engineering Research Center for Steel Construction	Prof K F CHUNG	2015
3.	The Hong Kong Polytechnic University	Hong Kong Branch of National Rail Transit Electrification and Automation Engineering Technology Research Center	Prof Yi Qing NI	2015
4.	City University of Hong Kong	Hong Kong Branch of National Precious Metals Material Engineering Research Center	Prof LU Jian	2015
5.	The Hong Kong University of Science and Technology	Hong Kong Branch of National Engineering Research Center for Tissue Restoration & Reconstruction	Prof Ben Zhong TANG	2015
6.	The Hong Kong University of Science and Technology	Hong Kong Branch of Chinese National Engineering Research Center for Control & Treatment of Heavy Metal Pollution	Prof CHEN Guang Hao	2015

III. Examples of Research Results in Recent Years

- (a) Discovery of new genes that suppress and facilitate colorectal cancer, as well as those that suppress and facilitate stomach cancer. It is envisaged that the research results could be applied to the screening, examination and prognostic analysis of cancers, as well as used as potential therapeutic targets;
- (b) Completion of an entire system assessment on attenuated influenza viral vector vaccines, demonstrating that the influenza vaccine of such system has a more comprehensive cross-protective effect and can achieve long-term immunity. The vaccine has been developed into the relevant influenza viral vector COVID-19 vaccine after the outbreak of COVID-19;
- (c) Analysis of the impact of commonly used larvicidal oil (“LO”) on marine life through seawater sampling in Hong Kong and ecotoxicological testing, with a view to optimising the usage of LO locally, facilitating the exploration of other effective means to control mosquito larvae, and minimising pollution to the marine environment;
- (d) Development of a curvature-adaptive multi-jet freeform polishing technology that can overcome the low efficiency problem of traditional waterjet polishing technologies. The new technology can be used for polishing various freeform surfaces, such as the complex 3D-printed surfaces, turbine blades, optical molds, and surfaces of microscale structure;
- (e) Development of a low-power Narrowband Internet of Things (NB-IoT) System-on-Chip (SoC) that integrates radio frequency power amplifiers and power management units to achieve wide-area IoT connections. The technology is licensed to famous multinational corporation companies, deployed in the end-products by several global customers, and creates a competitive advantage for local integrated circuit design companies and IoT solution providers; and
- (f) Four-generation iteration of a low-cost, energy efficient, innovative dynamic membrane bioreactor was conducted. The low-cost, portable membrane module can be easily assembled and operated in practical works. The technology can be applied for wastewater treatment and post-treatment.