

**TASK FORCE ON
REVIEW OF RESEARCH POLICY
AND FUNDING**

**INTERIM REPORT FOR
CONSULTATION**

June 2018

This Interim Report for Consultation is prepared by the Task Force on Review of Research Policy and Funding. Both the English and Chinese versions of the Report are available on the Internet at <http://www.ugc.edu.hk/>.

The findings and recommendations contained in this Interim Report do not represent the final views of the Task Force and is presented to invite views, comments or suggestions on the issues covered in the Report. Members of the public and stakeholders are welcome to forward their views on this Report and any other views on research policy and funding by post, email, or fax on or before 10 July 2018. All correspondence should be addressed to:

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It may be helpful for the Task Force, either in discussion with others or in any subsequent report, to be able to refer to and attribute comments submitted in response to this Interim Report. Any request to treat all or part of a response in confidence will, of course, be respected. In the absence of such request, the Task Force will assume that the response is not intended to be confidential.

The Task Force may acknowledge by name in subsequent document or report anyone who has responded to this Interim Report. If you do not wish such an acknowledgment, please state so in your response.

Review on Research Policy and Funding

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List of abbreviations

A*STAR	Agency for Science, Technology and Research [Singapore]
AHRC	Arts and Humanities Research Council [UK]
AIDS	Acquired Immune Deficiency Syndrome
AoE	Areas of Excellence Scheme
ARC	Australian Research Council
ARD of MoE	Academic Research Division of Ministry of Education [Singapore]
BBSRC	Biotechnology and Biological Sciences Research Council [UK]
BI	Broad Institute of Massachusetts Institute of Technology and Harvard
CE	Chief Executive
CIHR	Canadian Institutes of Health Research
CRF	Collaborative Research Fund
CRS	Cash Rebate Scheme
ECF	Environment & Conservation Fund
ECS	Early Career Scheme
EIT	European Institute of Innovation and Technology
EPD	Environmental Protection Department
EPSRC	Engineering and Physical Sciences Research Council [UK]
ERA	Excellence in Research for Australia
ERC	European Research Council
ERG	Earmarked Research Grant
ESRC	Economic and Social Research Council [UK]

ESS	Enterprise Support Scheme
EU	European Union
FHB	Food and Health Bureau
GDE	Gross Domestic Expenditure
GDP	Gross Domestic Product
GRF	General Research Fund
GSP	General Support Programme
HEIF	Higher Education Innovation Fund [UK]
HIV	Human Immunodeficiency Virus
HMRF	Health and Medical Research Fund
IAF	Industry Alignment Fund [Singapore]
ICP	Industry Collaboration Projects [Singapore]
IP	Internship Programme
ITC	Innovation and Technology Commission
ITF	Innovation and Technology Fund
ITSP	Innovation & Technology Support Programme
JRS	Joint Research Schemes
KICs	Knowledge and Innovation Communities [EU]
MGS	Matching Grant Scheme
MRC	Medical Research Council [UK]
MRP	Midstream Research Programme for Universities
NACRI	National Advisory Council on Research and Innovation [Canada]
NCGP	National Competitive Grants Programme [Australia]
NERC	Natural Environment Research Council [UK]

NIH	National Institutes of Health [USA]
NHMRC	National Health and Medical Research Centre [Australia]
NRF	National Research Foundation [Singapore]
NSERC	Natural Sciences and Engineering Research Council of Canada
NSF	National Science Foundation [USA]
NSFC	National Natural Science Foundation of China
ORCID	Open Research Contributor ID
PhD	Doctor of Philosophy
PICO	Policy Innovation and Co-ordination Office
PPR	Public Policy Research Funding Scheme
R-portion	Research Portion
R&D	Research and Development
RAE	Research Assessment Exercise
RCs	Research Councils [UK]
REF	Research Endowment Fund
RGC	Research Grants Council
RIEC	Research, Innovation and Enterprise Council [Singapore]
RIF	Research Impact Fund
RIIs	Research Institutes
RTDC	Environmental Research, Technology Demonstration and Conference
SBCs	Small Business Concerns
SF	Self-financing
SPPR	Strategic Public Policy Research Funding Scheme

SPRING	Standards, Productivity and Innovation Board [Singapore]
SSHRC	Social Sciences and Humanities Research Council [Canada]
SSRC	Social Science Research Council [Singapore]
STFC	Science and Technology Facilities Council [UK]
TRS	Theme-based Research Scheme
UGC	University Grants Committee
UICP	The University-Industry Collaboration Programme
UK	United Kingdom
UKRI	UK Research and Innovation
USA	United States of America

Chapter 1 Overview

Background

1.1 The Government attaches great importance to supporting the research work conducted by the post-secondary education sector. To nurture the younger generation to meet evolving needs and enable them to pursue their respective talents, the Chief Executive (CE) pointed out during her question-and-answer session at the Legislative Council on 5 July 2017 that the Government would carry out in-depth reviews on eight key areas of education. “Strengthening funding support for research” was one of them. On the invitation of the CE as announced in her Policy Address in October 2017, Professor Tsui Lap-chee convened the Task Force on Review of Research Policy and Funding, which is under the aegis of the University Grants Committee (UGC), to holistically review the research support strategy, the level of research funding and the funding allocation mechanism for the higher education sector in Hong Kong.

1.2 According to the Policy Address, the Government has set aside no less than \$10 billion as additional funding for university research which is ready for disbursement upon the completion of the review and subject to the recommendations made by the Task Force.

1.3 The CE also announced in the Policy Address that the Government has set a goal to double the Gross Domestic Expenditure (GDE) on Research and Development (R&D) as a percentage of the Gross Domestic Product (GDP), i.e. from 0.73% to 1.5%, by the end of the current Government’s five-year term of office, i.e. 2022.

Task Force on Review of Research Policy and Funding

Membership

1.4 Professor Tsui Lap-chee was invited to chair the Task Force. Composition of other members is as below:

- (a) five members from the industry and / or academic community who are conversant with the local research environment and / or have rich experience in translational research;

- (b) four ex-officio members including one each from the Education Bureau and the Innovation and Technology Commission (ITC) respectively, the Chairman of the Research Grants Council (RGC) and the Secretary-General of the UGC; and
- (c) the Chairman of the UGC as observer.

1.5 The full membership list of the Task Force is at **Annex A**.

Terms of Reference

1.6 The Task Force agreed on its Terms of Reference at its first meeting on 19 October 2017 as follows:

- (a) to review the existing research support strategy and the level and allocation mechanism of research funding for the higher education sector, including but not limited to funding provided by the UGC and the RGC (such as the Innovation and Technology Fund (ITF) and the Health and Medical Research Fund (HMRF)), taking into account the progress and latest development of the Review of the Competitive Allocation Mechanism of the Research Portion (R-portion) being conducted by the UGC, with options (but not limited) to:
 - (i) ensure the quality and excellence of research undertaken by the sector;
 - (ii) ensure that the world class research undertaken by the sector can meet the needs of and can translate into social and economic advantages for Hong Kong;
 - (iii) allocate research funding in a more streamlined and transparent manner;
 - (iv) provide incentives to the sector to engage and collaborate with industry and other end-users; and
 - (v) encourage the sector to engage in research commercialisation and knowledge transfer with industry and the community;

- (b) to consult stakeholders during the review and appoint external consultants to assist in the review as appropriate;
- (c) to consider any other issues in relation to the research regime in the higher education sector in Hong Kong as advised by the Government; and
- (d) having regard to the outcome of the review, to make recommendations to the Government through the UGC.

Work Plan

1.7 The Task force has so far held five meetings since its set up in October 2017. To start with, the Task Force has conducted stocktaking on the research funding schemes in Hong Kong and other jurisdictions in order to gain a better understanding on the existing financial resources available for research work. The Task Force has also determined a set of guiding principles for this review which will be covered in detail in Chapter 3. With a view to completing the review in a year's time, the Task Force aims to consult stakeholders' view by mid-2018 and to finalise on a recommendation report for submission to the Government by September 2018.

Consultation

1.8 The aim of the consultation exercise is to gauge views from various sectors to converge insights for the betterment of Hong Kong's development in research.

1.9 This Interim Report has been uploaded onto the UGC's web portal for ease of public access, and a press release on the commencement of the consultation exercise has been issued on 6 June 2018.

1.10 Invitations have been sent to all Heads of UGC-funded Universities / Self-financing (SF) Degree-awarding Institutions, RGC council / committee / panel members, research users and other major stakeholders to appeal for their participation in the consultation exercise. Further, presentation of the Interim Report will be held in June 2018 respectively for the Heads of UGC-funded Universities, Heads of SF Degree-awarding Institutions and the RGC for a focused discussion on the subject.

1.11 To collect feedback from the universities / institutions, a symposium will also be conducted in June 2018 to facilitate a fruitful exchange of views by the administrators, academics and researchers of UGC-funded universities and SF Degree-awarding institutions.

1.12 The consultation exercise shall end on 10 July 2018. All the feedback and views collected will then be studied and duly considered by the Task Force for incorporation as appropriate in its final recommendation report for submission to the UGC and the Government in September 2018.

Chapter 2 Present Situation

2.1 To gain a better understanding on the prevailing research funding schemes such as the nature of funding, eligibility, assessment criteria, etc., the Task Force conducted a round of stocktaking on research funding schemes available in Hong Kong and collected some relevant information on selected overseas funding bodies for reference. The findings as per the stocktaking exercise conducted in November 2017 are summarised in the ensuing paragraphs.

Research Funding Schemes in Hong Kong

2.2 At present, there are 28 government research funding schemes administered by various bodies: the RGC (17 schemes), the ITC (six schemes), the Food and Health Bureau (FHB) (two schemes), the Environmental Protection Department (EPD) (one scheme) and the Policy Innovation and Co-ordination Office (PICO) (two schemes).

Funding Schemes under the RGC

2.3 The RGC provides research funding to both the UGC-funded sector and the SF degree sector from the investment income of the \$26 billion Research Endowment Fund (REF). RGC's budget for competitive research funding schemes in the 2017/18 academic year is around \$1.2 billion.

2.4 The RGC administers 14 competitive research funding schemes for the UGC-funded sector in four categories, namely (a) Individual Research, (b) Collaborative Research, (c) Fellowship, and (d) Joint Research Schemes (JRS), and three competitive research funding schemes for the SF sector.

- (a) Individual Research includes the General Research Fund (GRF) and Early Career Scheme (ECS). The two schemes provide funding to small-scale projects with project duration of two to three years. The funding allocated to each project is between \$0.1 million and \$1.62 million. The success rate of the two schemes is about 33% and 38% respectively. GRF is the most popular RGC funding scheme, attracting over 2 700 applications per year.
- (b) Collaborative Research includes the Collaborative Research Fund (CRF), Theme-based Research Scheme (TRS) and Areas of

Excellence Scheme (AoE).

CRF provides funding to support medium-scale collaborative projects in the form of Group Research Grant and Equipment Grant. The funding allocated to each project is between \$2 million and \$10 million for a period of three to five years. The success rate is about 10%. CRF encourages collaborative research across disciplines and / or universities and acquisition of major research facilities / equipment for collaborative research.

TRS focuses on universities' academic research efforts on themes of strategic importance which are approved by the Government for the long-term development of Hong Kong. TRS provides funding between \$13 million to \$75 million per project to support large-scale collaborative research projects for a period of up to five years. A total of 35 projects were funded in the past seven rounds of exercise with a total funding allocation of over \$1,444 million. The success rate is about 10%.

Unlike other funding schemes of RGC, the funding of AoE comes from the UGC to support the UGC-funded universities to build upon their existing strengths and develop them into areas of excellence. AoE funding exercise is generally held biennially. 21 projects were funded in the past seven rounds of exercise with a total funding allocation of over \$1,317 million. The success rate is about 13%.

- (c) Apart from the research funding schemes mentioned above, the RGC runs two fellowship schemes which aim to recognise the outstanding humanities and social sciences academics and attract the best students globally to pursue Doctor of Philosophy (PhD) studies in Hong Kong.
- (d) The RGC also has seven JRS with funding bodies of other jurisdictions operating in the mode of project grants, travel / conference grants or fellowship.
- (e) The three funding schemes for the SF sector aim to develop the research capacity of both the institutions and their faculty members.

2.5 To encourage more impactful research and foster more collaborative efforts with stakeholders beyond academia, the UGC approved the establishment of a new funding scheme, namely the Research Impact Fund (RIF) in May 2017

on a pilot basis. The scheme is administered by the RGC and the UGC is allocating \$150 million for the first call of proposals which was issued on 31 January 2018 and closed on 9 March 2018. The UGC will consider later this year whether there will be a second round of scheme having regard to the results of this round, availability of funding and other factors.

Co-ordination with Other Funding Bodies

2.6 To enhance the co-ordination between the RGC and ITC, a representative of ITC is appointed as an ex-officio member of the RGC. To forge a closer link between the funding programmes between the two funding bodies, applicants of the RGC collaborative funding schemes are requested to provide an optional technology transfer plan in their funding applications for ITC's advance information. Once these applications are approved by the RGC, the ITC will be invited to keep in view of these projects and their progress. For projects with potential to proceed to the applied R&D phase, the project teams will be encouraged to apply for the ITF so that these projects could receive further funding support from the ITF. Agreement has been reached between the RGC and the ITC to extend the optional technology transfer plan arrangement to projects with high technology transfer potential from individual funding schemes (i.e. GRF and ECS) starting from the 2018/19 exercise with a view to enhancing a closer link between the two units.

Funding Schemes under ITC

2.7 The ITF, administered by the ITC, provides financial support for applied research as well as R&D activities. An appropriation of \$5 billion was approved to the Fund at its start. The ITF administers six funding schemes which support R&D and nurture technology talent.

2.8 The Innovation & Technology Support Programme (ITSP) (platform projects) supports midstream / downstream R&D projects undertaken by local universities, SF Degree-awarding institutions, R&D Centres and designated local public research institutions. There are two streams under ITSP (platform projects), one for Platform/Tier 3¹ projects for local universities and SF Degree-awarding institutions, and the other for Platform/Seed/Tier 3¹ projects for R&D Centres and designated local public research institutions². For projects funded under ITSP (platform projects), the project period could be up to 24 months. Platform projects require industry sponsorship of at least 10% of the

¹ Seed/Tier 3 projects are more forward-looking and exploratory projects that aim to provide foundation work for future platform/collaborative projects.

² There are five R&D Centres and four designated local public institutions.

total project cost. Seed/Tier 3 projects do not require industry sponsorship. For the first stream, 111 applications were approved in 2016/17 with a total funding of \$240.5 million. The success rate is about 18%. The range of funding per project is from \$0.2 million to \$9.3 million. For the second stream, 83 applications were approved in 2016/17 with a total funding of \$353.5 million. The range of funding per project is from \$0.2 million to \$12 million. The success rate is about 67%.

2.9 The University-Industry Collaboration Programme (UICP) and ITSP (collaborative projects), which will be subsumed under the new Partnership Research Programme in 2019, aims to stimulate private sector interest in R&D through leveraging the knowledge and resources of the public sector, and to support collaborative projects undertaken by private companies in collaboration with local universities, SF Degree-awarding institutions, R&D Centres, or designated local public research institutions in the form of matching grant. The private company has to contribute at least 50% of the project cost. 89 applications were approved in 2016/17 with a total funding of \$140.1 million. The success rate is about 80%. The funding allocated to each project is between \$0.2 million and \$3.9 million for a period of up to three years.

2.10 The R&D Cash Rebate Scheme (CRS) aims to reinforce the research culture among private companies and encourage them to establish stronger partnership with designated local public research institutions by providing 40% cash rebate of their contribution to ITF and partnership projects. A total funding of \$72.4 million was provided to 285 approved applications in 2016/17. The range of funding was from \$4,000 to \$3 million. The success rate is 100%.

2.11 The Enterprise Support Scheme (ESS) aims to bring impetus to encourage more private sector investment in R&D activities. Limited companies registered in Hong Kong, regardless of their size, are eligible to apply. The funding ceiling for each approved project is \$10 million and funding will be provided on a dollar-for-dollar matching basis. The maximum project period generally does not exceed 24 months. A total funding of \$38.6 million for 15 applications was approved in 2016/17 with a success rate of 22%. The range of funding is from \$0.2 million to \$7.6 million.

2.12 The Midstream Research Programme for Universities (MRP) was launched in December 2016. It encourages universities to collaborate with leading research institutions worldwide to conduct more inter-disciplinary and multi-institutional translational R&D work in focused technology areas, such that more research outcomes could be made available for further downstream research work or product development. The funding ceiling of the MRP is

\$5 million but may be up to \$10 million per project if it involves collaboration across multiple disciplines, universities or research institutions. The maximum project period is 36 months. Applications are invited every year. The first round of application ended in March 2017. Eight projects with seven of them involving collaboration across disciplines or institutions were supported with a total funding of about \$34 million. The 2018 MRP application exercise commenced on 28 February 2018 and closed by 30 April 2018.

2.13 The Internship Programme (IP) under the General Support Programme (GSP) and the new scheme “Postdoctoral Hub” to be launched in the third quarter of 2018 aim to provide funding for nurturing new talent in R&D. The IP supports university graduates to pursue a career in innovation and technology and it provided a total funding of \$99.9 million for 389 awardees in 2016/17 with a success rate of 86%.

Funding Schemes under FHB

2.14 The HMRF aims to build research capacity and to encourage, facilitate and support health and medical research to inform health policies, improve public health, strengthen the health system, enhance healthcare practices, advance standard and quality of care, and promote clinical excellence, through the generation and application of evidence-based scientific knowledge in health and medicine. It also provides funding support to evidence-based health promotion projects. Research funding is provided through (i) Investigator-initiated Research Projects; (ii) Health Care and Promotion Scheme; (iii) Research Fellowship Scheme and (iv) Commissioned Research Programmes / Studies or Health Promotion Programmes / Projects. The normal funding duration is two years. About 150 to 260 projects were funded from 2014/15 to 2016/17 with a total funding between \$145 million and \$304 million. The size of funding per project is between \$41,000 and \$31.5 million. The success rate of (i) is between 16.5% and 28.1%. For (iii), the first open call was issued in August 2015, and the applications of the said round were approved in 2016/17 with a success rate of 50%.

2.15 The Acquired Immune Deficiency Syndrome (AIDS) Trust Fund provide assistance to human immunodeficiency virus infection (HIV)-infected haemophiliacs and generally to strengthen medical and support services, public education, and research on AIDS. In 2015/16, four projects with a total funding of \$3.9 million were approved. The maximum project period is three years. The range of funding per project is from \$0.41 million to \$2.6 million. The success rate is 44%.

Funding Scheme under EPD

2.16 The Environmental Research, Technology Demonstration and Conference (RTDC) Projects funding scheme of the Environment & Conservation Fund (ECF) provides funding support for environmental research, technology demonstration and conference projects initiated by non-profit-making organisations. The projects should be applied research in nature. For technological demonstration projects in particular, the benefits must accrue to one or more industries, and not just individual companies. Successful projects should be publicised so as to disseminate the results and to ensure widespread adoption of the technologies by relevant sectors. 24 projects were funded in 2016/17 with a total funding of \$28.9 million. The size of funding per project is between \$0.247 million and \$4.2 million and the maximum project period is three years. The success rate is 21%.

Funding Schemes under PICO

2.17 There are two funding schemes under the PICO, namely the Public Policy Research Funding Scheme (PPR) and the Strategic Public Policy Research Funding Scheme (SPPR). PPR provides funding to promote public policy research and develop the human resources required. Applications are accepted all year round and about 30 projects with an approximate funding of \$17 million were approved per year in 2015/16 and 2016/17. The size of funding per project is between \$0.195 million and \$1.63 million and the normal project duration is between six and twelve months. The success rate is between 35% and 39%. The objective of SPPR is to facilitate longer-term public policy research on specific areas with a project duration ranging from three to five years. Three projects with a total funding of \$9.8 million were approved in 2016/17 and the funding size per project is between \$3 million to \$3.4 million. The success rate is 7%. PICO will organise forums and seminars for researchers to present their research findings with stakeholders.

Funding from non-Governmental Sector

2.18 The Croucher Foundation is one of the private foundations established in Hong Kong dedicated to promoting the standard of natural sciences, technology and medicine in Hong Kong. It supports the career development of promising early career and mid-career scientists and facilitates the exchange of ideas among scientists in Hong Kong, Mainland and overseas. In the past three years, around 60 projects were awarded per year with a funding between \$65 million and \$81 million. The size of funding per project is

between \$0.1 million and \$5 million. The success rate is between 15% and 18%. The project duration is usually shorter than six years.

Research Funding Schemes in Other Jurisdictions

2.19 Apart from the information related to the research funding in Hong Kong, the Task Force has also collected and studied some information on research funding in other jurisdictions, including Mainland, Australia, Canada, Singapore, the European Union (EU), the United Kingdom (UK) and the United States of America (USA). Information gathered on those overseas jurisdictions is summarised at **Annex B**.

Nature of Research Funding Schemes

2.20 It is noted that the nature of the research funding schemes / programmes provided under the funding bodies of the jurisdictions as set out at Annex B can be broadly classified into the following categories:

(a) Basic / Applied research

Basic research aims to create knowledge and provide support to researchers for new research ideas while applied research is goal directed and seeks to acquire and apply knowledge for practical application. Such nature of research is commonly found in all funding bodies.

(b) Transformative (midstream) research

To support the translation of research outcomes into useful products. Examples such as the “Central Gap Fund” under the NRF of Singapore and the “Transformative Research Technologies Funding” provided by the BBSRC with two other RCs in the UK.

(c) Collaborative research

(i) collaboration between universities / research institutes and industries, e.g. “Industry Alignment Fund (IAF) Pre-Positioning Programmes” in Singapore and “Proximity to Discovery : Industry Engagement Fund” of RCs in the UK;

- (ii) collaborative research across disciplines, e.g. Transformative Research Technologies Funding in the UK;
 - (iii) collaboration between local and overseas universities, e.g. Joint Research Schemes of A*STAR (Singapore), “Climate Change and Atmospheric Research” from NSERC (Canada) and “Linkage Programmes” from ARC (Australia); and
 - (iv) collaborative research across countries / nations to support international and interdisciplinary collaborations in research, such as the “Collaborative Grants” from NHMRC (Australia), “Collaborative and Thematic Resources in Mathematics and Statistics Programme” under the NSERC (Canada) and “Newton Fund” under the RCs in the UK.
- (d) Partnership programme / research between researchers and policy makers / private sector

These programmes aim to provide support to partnership between researchers and organisations from the public or private sector. Examples such as “Partnership Grants” from SSHRC of Canada, “Knowledge Transfer Partnerships” under the ESRC of the UK, “Industry Collaboration Projects (IAF-ICP)” under the A*STAR of Singapore and the “Partnership Projects” from NHMRC of Australia.

- (e) Target-based research

The focus of research is chosen by the funding bodies according to the jurisdiction’s research priorities, e.g. “NHMRC - EU Collaborative Research Grants” and “NHMRC and NIH BRAIN Initiative Collaborative Research Grants” under the NHMRC of Australia.

- (f) Equipment / Infrastructure Grants

Such grants aim to support the procurement of equipment or infrastructure, e.g. the “Research Tools and Instruments Grants” from the NSERC of Canada and “Equipment Grants” from NHMRC of Australia.

(g) Fellowship programmes

These programmes aim to nurture researchers, e.g. “Australian Laureate Fellowships” under the ARC of Australia, “NRF Fellowship” from NRF of Singapore, “Fellowships for Young International Scientists” under the Chinese Academy of Sciences.

Recent Trend of Development in Overseas Research Funding Bodies

Higher Level Strategies

2.21 It is noted that some jurisdictions are transforming to a research ecosystem that comprises various ministries or research funding bodies / R&D performers but headed by a centralised strategic council or advisory board to steer and formulate strategic plan in respect of the research policy and funding. For instance, in Singapore, the RIEC, supported by the NRF Board, oversees the long-term strategy in research policy for the nation. The UKRI, newly formed in April 2018, brings together the seven RCs, Innovate UK and a new organisation, Research England, headed by the UKRI Board, and operates across the whole of the UK with a combined budget. The UKRI Board plays a critical role in providing strategic direction and oversight, promoting the importance of UK science and innovation with a view to strengthening the UK’s strategic approach to future challenges and providing a strong and unified voice for the UK’s research and innovation community on the global stage.

2.22 The formation of UKRI is brought about by a review of the research policy and funding in the UK, namely “A Review of the UK Research Councils” by Sir Paul Nurse (Nurse Review) in 2015. The review was requested by Ministers of the UK Government following publication of the UK Government’s Science and Innovation Strategy. The Nurse Review indicated that to maintain research strength across the board and promote high quality research with responsiveness to new developments and needs, the RCs should build on pre-existing research strengths and provide the leadership to support both the overall vigour and connectivity of the UK research base and to link knowledge with innovation and benefits for society. To support a high-level strategic discussion including analysis of strengths, weaknesses and gaps in UK research portfolio, the RCs should take ownership of mapping the UK research landscape to produce a consolidated picture of capability across RCs, Innovate UK, Government departments, local authorities, other public agencies and industries and how to access research funding support, including making these data widely

available. Against this background, the UKRI was proposed to be set up for formulating overall research strategy for the UK.

2.23 Similar to the UK, Canada conducted a review of the federal system of support for research and funding arrangements in 2016. The review concluded that Canada's federal research ecosystem was weakly coordinated and inconsistently evaluated. It further recommended the formation of a new National Advisory Council on Research and Innovation (NACRI) to provide broad oversight of the federal research and innovation ecosystems, and to review the current allocation of funding across the granting councils.

Enhancement on Applied Research & Engagement of Commercial Sector

2.24 Among the overseas jurisdictions examined, there seems to be a trend to put increasing weight on research with commercialisation potential or business-focused research collaboration programmes. For example, after a review on research policy and funding arrangements in 2015, the two major funding bodies in Australia, ARC and the NHMRC, allow increasing recognition of industry experience alongside research excellence, and encourage collaboration between researchers and the industry. The ARC actualised the above initiatives in its funding programmes by agreeing to establish expert panels to assess the elements of ARC grant proposals that relate specifically to commercialisation potential and collaboration with businesses and other end-users for funding exercises from mid-2016 onwards. The ARC also announced in October 2017 to allocate AUS \$4.3 million (~HK\$26.01 million) to support ten new collaborative research projects under the Linkage Projects Scheme. 18 partner organisations, in addition to ARC funding, would provide a further AUS \$7.1 million (~HK\$42.96 million) in cash and in-kind over the duration of the projects, fostering a stronger industry-research link.

2.25 For the case in the UK, one of the commitments of the UKRI is to translate research into better business outcomes effectively and identify the commercial potential in new technologies. As indicated in the Nurse Review, the inclusion of the Innovate UK, the UK's innovation agency which aimed to fund, support and connect innovative business to accelerate sustainable economic growth, into the UKRI was to help promote and catalyse interactions between the academic and business communities.

Summary of Observations

2.26 From the experience of other jurisdictions, collaboration and research impact are the main focuses in the latest trends of research development.

In some jurisdictions, a centralised strategic council or advisory board is formed to steer and formulate strategic plan in respect of the research policy and funding and to facilitate communication amongst the funding bodies.

2.27 The funding bodies of other jurisdictions provide a wide range of funding to support both basic and applied research and to meet the needs of researchers at different stages of their careers. In the past, researchers heavily relied on government funding to carry out research. At present, researchers tend to seek more funding from the industry / private foundations. Through various collaborative funding schemes, the funding bodies encourage researchers to engage partnership with the industry / community organisations, increasing industry's participation and support to research. As a result, funding bodies have become more focused on the academic, societal and economic benefits of the research outcomes.

2.28 There is increasing emphasis on collaborative research as evident in various modes of cross-institutional and cross-disciplines collaboration being put in place in overseas to bring together resources and knowledge across different fields, technologies and disciplines. One of the representing examples is the Broad Institute of Massachusetts Institute of Technology and Harvard (BI).

Chapter 3 Guiding Principles for Research

3.1 To facilitate the review, the Task Force has deliberated and agreed upon a set of guiding principles for adoption in the Task Force's discussion of the existing research support strategy and the level and allocation mechanism of research funding for the higher education sector in Hong Kong. The set of guiding principles has also been a reference base for the Task Force to make suggestions to further enhance the quality and excellence of research undertaken by the sector, and to promote research which can be translated into social and economic advantages for Hong Kong.

Guiding Principle I: High Quality Research with Social Impact

3.2 While commercialisation of research outcomes is essential to make R&D become a pillar of the economy, high quality research with social impact is also crucial to the future development of Hong Kong. The term "social impact" should be broadly defined to include both tangible and intangible benefits of research outcomes and the specialty of each discipline should be taken into account. Quality research should therefore pass threshold in both academic merit and potential research impact. In this connection, impact should be defined as the demonstrable contributions, beneficial effects, valuable changes or advantages that research qualitatively brings to the economy, society, culture, public policy or services, health, the environment or quality of life; and that are beyond the academia.

Guiding Principle II: Adequate Support for Funded Research

3.3 The ratio of GDE on R&D to GDP in Hong Kong has been on the low side, ranging between 0.72% and 0.79% from 2011 to 2016. It does not compare well with that in the neighbouring and global peers as their respective ratio is between 1.7% to 4.2%. For Hong Kong to compete favourably in terms of R&D, new funding will be required to sustain the support for research with strategic impact and promote more competitive research of high quality.

3.4 The REF was established in 2009 to provide a certain and stable source of funding to support academic research. In recent years, there is concern that the investment income is insufficient to meet the budget of the research funding schemes administered by the RGC due to the relatively low investment return rate of the REF compared with the period when the fund was first established.

3.5 Adequate support for funded research in terms of size and duration of grants, as well as the associated on-costs / overheads is essential. There is therefore call for new injection of funding to meet the requirement. In addition to financial resources, support endeavoured to make the physical environment more favourable for promotion of academic exchange and collaboration should also be strengthened.

Guiding Principle III: Balance among Basic, Translational and Applied Research

3.6 Research process is a continuum and is difficult to separate into distinct units. However, for the purpose of research funding, it is customary to break down research into basic, translational and applied. Nonetheless, it is difficult to make generalisation about the ideal balance among basic, translational and applied research because it depends on the nature of different disciplines and particular research programmes. Specific knowledge and understanding of the research area under study is required to facilitate consideration of the appropriate balance among these different modes of research activity.

Guiding Principle IV: Funding for Both Large-scale Programmes and Individual Projects

3.7 To meet the increasing complexity and multi-dimensionality of many societal and global challenges, cross-institutional / cross-disciplinary collaboration to bring together researchers from across various disciplines, universities / institutes should be encouraged. Although funding is currently available for such research, joint projects of such nature are mostly on a small scale and time-limited.

Guiding Principle V: High Quality Peer Review

3.8 High quality peer review is the cornerstone to ensure quality of research. Effort should be taken to ensure that the quality of reviewers as well as the assessment process and procedures meet high standard. Selection of reviewers would take into account different types of research such as basic and applied that require experts of different background while assessments of multi-disciplinary and inter-disciplinary proposals will undoubtedly require a wider range of reviewer expertise.

Guiding Principle VI: Collaboration and Coordination among Research Funding Bodies

3.9 The Government is currently providing research funding to the higher education sector through a number of government research funding schemes administered by various funding bodies, including the EPD, FHB, ITC, PICO and RGC. There are also funding schemes provided by private entities such as the Croucher Foundation. As these funding schemes have different objectives, target participants, assessment criteria, funding period, etc., and are administered by the respective funding bodies independently, it is considered that collaboration, if appropriate, and coordination among different funding bodies should be strengthened and enhanced with a view to providing better steering and avoiding overlapping / wasting of resources, and to improve the research ecosystem in Hong Kong in the long run.

Guiding Principle VII: Sustainable Strategies and Support for Research Talent and Infrastructure

3.10 To nurture, retain and expand our pool of research talent would be of paramount importance in supporting the advancement of R&D and cultivating the research culture in Hong Kong. Promising academics should be provided with opportunities and incentives at their early / mid-career to develop their potential in full, encourage them to contribute and drive them to research excellence.

3.11 To support the government initiatives to promote innovation and technology via the formation of technology clusters or the establishment of independent research institutes jointly owned by universities, universities should be given flexibility in defining their staffing arrangements or contractual issues.

Guiding Principle VIII: Diversified Funding Sources to Include Private, Industrial and Philanthropic Support

3.12 In Hong Kong, funding for R&D has all along been government-led and the share of business sector in R&D expenditure takes up less than 45% over the years. To enhance the impact of the funding for research and diversify the source of financial support, more non-government funding from the private sector and / or philanthropists should be attracted.

Chapter 4 Review and Recommendations

4.1 Since its set up in October 2017, the Task Force has proceeded in full swing to review the existing research support strategy and the level as well as the allocation mechanism of research funding for the higher education sector. The goal is to ensure the quality and excellence of research undertaken by the sector to meet the needs of and be translated into social and economic advantages for Hong Kong. The Task Force has also reviewed the funding allocation mechanism and explored options to allocate research funding in a more streamlined and transparent manner; provide incentives to the sector to engage and collaborate with industry and other end-users; and encourage the sector to engage in research commercialisation and knowledge transfer with industry and the community. The preliminary review results and recommendations are summarised in the ensuing paragraphs.

Substantial Increase in Research Funding

Doubling Funding for Competitive Research

4.2 In Hong Kong, the ratio of GDE on R&D to GDP was between 0.72% and 0.79% from 2011 to 2016. This ratio is much lower than that in a number of jurisdictions such as Mainland China, Singapore, South Korea, the UK and the USA as their respective ratio is between 1.7% to 4.2%. To this end, the CE announced in her Policy Address in October 2017 that the Government had set a goal to double the ratio from 0.73% to 1.5% by the end of the current Government's five-year term of office. This goal should be achieved with the concerted effort of all Government and private entities, including the business sector, higher education sector and Government sector. Considering that it would also take time for the community to expand its research capacity, the allocation of new resources should be made available by phases.

4.3 While the element of competitiveness in allocating research funding helps promote research excellence in the sector, it is noted with concern that the expenditure on competitive R&D in Hong Kong constitutes only 0.07%³ of GDP, while that in the UK, Canada and the USA is in the range of 0.15% to 0.24% of respective GDP. On the back of CE's pledge to double the ratio of GDE on R&D to GDP from 0.73% to 1.5% by 2022, the overall funding for competitive research should also be proportionately doubled from the prevailing

³ for competitive research funding only

\$2 billion to \$4 billion per annum by then.

4.4 At present, the RGC administers a total of 17 competitive research funding schemes, 14 of which are for the UGC-funded sector whilst three are for the SF degree sector. The RGC's budget for competitive research funding schemes in the 2017/18 academic year is around \$1.2 billion. In consideration that universities could conduct more impactful and translational research projects in meeting Hong Kong's needs, the RGC endorsed to launch in 2018 a new competitive funding scheme, namely the RIF, on a pilot basis to strengthen midstream research programmes for universities. The funding requirements will be met initially from the UGC's Central Allocation Vote. New funding will be required for the RGC to sustain the support for research with strategic impact and to promote more competitive research of high quality. For the overall funding for competitive research to be doubled in four years, it is therefore reasonable to assume that additional funding from the Government would be forthcoming to double the annual research funding of RGC from around \$1 billion to \$2 billion over the same period.

4.5 Moreover, the recent announcement by the Central Government in respect of the flow of cross-boundary funding resources from the Mainland to Hong Kong is considered an opportune source of research funding. Such a breakthrough should greatly benefit R&D in Hong Kong and help bring a new impetus to the research sector.

Recommendation 1

The Government to provide new funding to support R&D development with a view to doubling the overall competitive research funding in Hong Kong from the prevailing amount of about \$2 billion to \$4 billion per annum by 2022, including the doubling of RGC funding from \$1 billion to \$2 billion over the same period.

Ensuring Sustainability of Research Funding

4.6 Sustainability of research funding is important to attract and retain talents for the long-term planning of human resources and the development of the research ecosystem of Hong Kong. The Government should show strong commitment to the sustainability of funding by offering appropriate long-term funding strategies. Strategies for endowment research funding need to be credible and viable to meet the annual disbursement needs with an upfront

outlay that is affordable and acceptable to the public, taking into account the economic environment of the times.

4.7 The REF was established in 2009 with a capital of \$18 billion to provide a source of stable funding to support academic research. The REF was topped up by \$5 billion in 2012. As mentioned above, the RGC administers a total of 17 competitive research funding schemes and the funding source for 15 schemes is from the interest return of REF, while two are supported by UGC funds. Although there is an increasing demand for the funding support from the REF, the allocation to the Earmarked Research Grant (ERG) under the REF could not address the additional demand and cover inflation but maintained at some \$800 million per year since 2014/15 due to budget constraint. The annual investment return rate of the REF has been declining from 6.8% in 2009 to 2.8% in 2017⁴. Though the return rate is expected to rise to 4.6% in 2018, this is to a large extent due to a one-time stock market performance in 2017. The decline of the annual return of the REF in average over the past years remains a concern for the UGC as it is expected that the projected investment income (the medium-term return rate is 4%) of the REF in the years to come would not be sufficient to cover the schemes under the ERG on a sustainable basis.

4.8 As a consequence of the decline in the investment return, the REF suffered a deficit of about \$370 million in 2016/17. While there is an option that the funding provided by the RGC need not be confined to the investment return of the REF and part of the principal can be drawn as appropriate, it is necessary for the REF to be topped up with an injection of new capital such that the annual return can be restored to a level sufficient to meet the requirements in the long-run.

4.9 To address the concern on the decline in the investment return of the REF and the funding requirement for competitive research, provision of new resources from the Government is required. New funding resources in the form of an injection to the REF will indeed provide a more stable source of funding and should hence be welcomed by the higher education sector. As

⁴ Investment return rate of the REF over the past 10 years is as follows:

2009:	6.8%
2010:	6.3%
2011:	6.0%
2012:	5.6%
2013:	5.0%
2014:	3.6%
2015:	5.5%
2016:	3.3%
2017:	2.8%
2018:	4.6% (expected)

announced by the CE in her Policy Address in October 2017, the Government had set aside no less than \$10 billion as additional funding for university research which would be disbursed upon completion of the review and subject to the recommendations made by the Task Force. To this end, it has been anticipated that the Government would inject no less than \$10 billion to the REF so that the annual return can be restored to a level sufficient to meet the requirements in the long-run. Additional research funding mechanisms or strategies may need to be introduced in a timely and strategic manner to ensure that adequate resources are provided to support the initiatives as proposed in the following sections of this report.

Recommendation 1a

To inject substantial new money into the REF to make up the shortfall due to the reduction in the annual rate of return, in order to sustain the current funding for research.

More Flexible and Effective Deployment of Funding Resources

4.10 The REF is currently divided into four pots of money, i.e.:

ERG	\$16 billion
TRS	\$4 billion
Competitive Research Funding for Local SF Degree Sector	\$3 billion
Studentships for Research Postgraduates	\$3 billion

4.11 Due to historical reasons, the different pots are ring-fenced and cannot be re-deployed to other purposes within the ambit of the REF. While there is severe deficit in the ERG pool, it is expected that there may be surpluses in the others. It is suggested to remove the above-mentioned restriction so that the RGC may, after having fully met the original intentions of the different schemes, including providing sufficient research funds for self-financed institutions, theme-based research and fully covering the tuition fees of all local students of all UGC-funded research postgraduate programmes, flexibly redeploy the uncommitted funding for other pressing requirements. In conjunction with the enhancement of the capital, it is therefore considered desirable as well to rationalise the use of different pots of REF for more effective and flexible deployment of funding resources.

Recommendation 1b

To rationalise the use of different pots of REF for more effective and flexible deployment of funding resources.

To Boost Research Support from the Private Sectors including Donations

4.12 Investing in research has major multiplier effect that benefits not just the researchers but also the business sector and the society as a whole. As such, it is important to entice the support and engagement of other stakeholders in the research enterprise. For all those economies with a high ratio of research expenditure to GDP (e.g. Mainland China and Singapore), it is noted that the major driver is the private sector and not the government whereas in Hong Kong, funding for R&D has all along been government-led, despite the fact that we do not have research expenditure on national defense. As indicated in the table at **Annex C**, the share of business sector in R&D expenditure takes up less than 45% over the years. As an inducement to private companies to increase investment in technological R&D, the Government has undertaken to provide additional tax deduction for expenditure incurred by enterprises on R&D. It is hoped that with this measure, the ratio of private sector expenditure on R&D would be increased, which will make R&D funding more sustainable.

4.13 To enhance the impact of the funding for research and to diversify the funding sources, it is desirable to attract more non-government funding from the private sector and / or philanthropists via donation matching. To strengthen the higher education sector's fund-raising capabilities and encourage the growth of a philanthropic culture in the community, the Government introduced the concept of Matching Grant Scheme (MGS). Since its first introduction in 2003, institutions had raised some \$14.8 billion in private donations and a total of \$7.4 billion of matching grants had been allocated over the past six rounds of the MGS. The sum total was an additional \$22.2 billion for the universities over the past decade or so. The seventh round, covering the SF post-secondary education sector, was launched in August 2017 for a period of two years and the Government has reserved \$500 million for such matching purpose. The MGS has been successful in cultivating a stronger philanthropic culture in the community towards investment in education, fostering diversification of funding sources and securing additional resources for the provision of quality higher education. To this end, the Financial Secretary has proposed in the 2018-19 Budget to allocate \$2.5 billion to launch the eighth MGS for 10 publicly funded post-secondary education institutions.

4.14 Although the previous MGS scheme was not specifically targeted for research purpose, many institutions had based their fund-raising strategies in supporting research. Having regard to the success of the MGS, it is recommended that the Government should introduce a specific grant matching scheme, namely, Research Matching Grant Scheme, and invite the private sector to join hands in providing funding support to the post-secondary sector. R&D expenditure and donations from the private sector, industries and philanthropists secured by individual local degree-awarding institutions would be matched by the Government for research-related purpose. It is acknowledged, however, that ITF has operated the UICP since 1999 but, if affirmative, the scheme proposed here will be the first time the Government set up an ‘unspecified’ matching grant specifically for research. As R&D expenditure and donations can be made for a particular university / project / discipline and the Government will match the donations, universities will then be able to tap more funding sources to conduct large-scale research and enhance the fostering of a philanthropic culture.

Recommendation 1c

To boost private R&D expenditure and donations in the research community by setting up a Research Matching Grant Scheme for local degree-awarding institutions.

Sustainable Strategies and Support for Research Talent

4.15 As mentioned in CE’s Policy Address in October 2017, the Government has been actively promoting the R&D in Hong Kong in recent years. For Hong Kong to be developed into an international research hub, sustainable strategies and support for research talent and to cultivate the research culture are pre-requisites to the path of success. As such, it is imperative to secure a supply of talent with scientific and research skills for the R&D in Hong Kong. To this end, a number of new initiatives are suggested.

Nurturing New Talent: Postdoctoral Fellowship

4.16 In the course of building up the momentum of R&D, pooling of research talent and nurturing them at early stage is essential and crucial to meet future challenges. Over the past decade, the UGC has endeavoured to enhance the support for research postgraduates such as setting up the Hong Kong PhD Fellowship Scheme in 2009. Starting from the 2018/19 academic year,

non-means-tested studentships will be provided to eligible local students enrolled in UGC-funded research postgraduate programmes. In the light of the growing importance of research activities, it is considered beneficial to augment the support to cover post-doctorate graduates in Hong Kong. To further build up our research talent pool and to nurture a research culture, a new scheme to support postdoctoral researchers should be introduced. The proposed scheme aims to encourage doctoral graduates in pursuing career in research and provide support to promising researchers at a pivotal time in their careers, so as to secure a supply of talent with scientific and research skills for R&D in Hong Kong.

4.17 The proposed scheme should be competitive in nature. As a starting point, it is proposed to provide 50⁵ places in each round of exercise, and applications will be divided into two broad streams (i.e. Science and Technology, including medicine and engineering; and Humanities, Social Science and Business Studies). Each awardee is suggested to be granted with a fellowship stipend for a maximum of three years with the support of a UGC-funded university. Subject to the number of quality applications and comments from the relevant subject expertise, the number of places and the amount of stipend will be reviewed as appropriate in future.

Sustained Development of Research Talent: Research Fellows and Senior Research Fellows

4.18 For Hong Kong to be developed into an international research hub, sustainable development of research talent is as equally important as nurturing and grooming new ones. As such, ensuring adequate support for full-time researchers is also of paramount importance and therefore other initiatives are proposed. Modelling on similar schemes offered by the Croucher Foundation locally and other funding agencies elsewhere, it is suggested to introduce two additional fellowship schemes, namely RGC Research Fellow and RGC Senior Research Fellow (for applicants at Associate Professor and Professor levels respectively). The duration of support should be for five years in the first instance, to provide sustained support for the research development of a small group of exceptionally outstanding academics. As a start, the Task Force would like to propose the award of 10 to 15 RGC Research Fellows and up to 10 RGC Senior Research Fellows in each round of exercise. These initiatives should help strengthen the research staff force and assist the universities to attract and retain talent.

⁵ Such number of places accounts for 3.6% of the total number of PhD graduates from full-time UGC-funded programmes in 2015/16.

Recommendation 2

To strengthen the research staff force and to nurture / sustain the development of research talent by introducing three fellowship schemes, namely a postdoctoral fellowship scheme, a research fellow scheme and a senior research fellow scheme under the RGC.

Support for Research Infrastructure

Better Efficiency and Effectiveness in the Use of Competitive Research Funding

4.19 To meet the challenges arising from the increasing number of applications and growing complexity of the selection mechanism, the UGC and the RGC decided previously to conduct the RGC Review and to do so in two phases. The Phase I Review, completed in May 2017, had examined macro issues such as the portfolio balance of the research funding schemes administered by the RGC, the RGC's structure and good practice in overseas funding agencies. It is suggested that the RGC Phase II Review should study issues including the time commitment of the Principle Investigators, quality of the assessment, monitoring processes conducted by the RGC assessment panels and committees as well as project renewal.

Recommendation 3

RGC's Review (Phase II) to include technical aspects such as time / commitment of Principal Investigators, quality of assessment, monitoring processes and project renewal.

Strengthening the Effectiveness of the R-Portion

4.20 Recurrent grants provided by the UGC to each UGC-funded university comprise a Block Grant and funds provided for specific purposes. The amount of Block Grants to universities is calculated based on three elements, i.e. teaching, research and professional activity. The R-portion, constituting about 23% of the Block Grant, is disbursed to the universities as infrastructure funding to enable universities to provide both the staffing and facilities necessary to carry out research, and to fund a certain level of research. The

current mechanism adopted for R-portion serves as a proxy reference for allocation and the disbursement of the Block Grant. It would allow universities to have autonomy in and responsibility for determining the best use of the resources vested with them.

4.21 The feedback received from the research sector over the years in connection with the allocation mechanism of the R-portion are summarised below.

Effectiveness in Achieving the Intended Objectives

4.22 The objectives of introducing a competition element into the allocation mechanism of the R-portion are to promote research excellence by linking it to achievements on competitive research award. As the Research Assessment Exercise (RAE) is being conducted every six years or so, there has been concern on whether there are other alternatives that may provide more updated information of universities' latest research output. Moreover, the size of the R-portion is about four times the total amount of funding available for competitive research grant bidding under the RGC. In the light of the development and the research performance of the UGC sector since the implementation of the competitive allocation mechanism of the R-portion, the effectiveness of the mechanism against its intended objectives should be revisited and evaluated to ascertain whether the objectives are being met in full.

Institutional Funding Stability

4.23 The UGC Block Grant serves to provide stable recurrent funding to universities. As the R-portion is disbursed to meet the expenses for staffing and facilities pertinent to research activities, it warrants further study on whether the prevailing funding allocation mechanism is having beneficial effect to universities as far as the stability of funding is concerned.

Calculation Basis

4.24 Under the prevailing arrangement, the funding results in the past 12 months of the competitive peer-reviewed schemes under the RGC ERG are adopted for the calculation of the competitive R-portion. This is on the consideration that the annual competitive allocation should reflect the latest performance of universities in obtaining the RGC ERG, and that the arrangement encourages competition and provides timely feedback on universities' research performance. One of the sector's concerns in this regard is that the funding results in the immediate past 12 months may not necessarily

be representative of the performance of the university concerned in obtaining the RGC ERG.

4.25 Requests have been raised by the sector from time to time to include non-UGC/RGC grants, such as the ITF and HMRF, in the calculation of the competitive part of the R-portion. Given the views of the sector, there is a need to revisit the funding schemes adopted for calculation of the competitive part of the R-portion, and considering whether it is beneficial to impose certain criteria/standards in respect of any funding schemes for inclusion in the calculation of the competitive R-portion. For example, the scheme(s) must be competitive; the grant application(s) must be peer-reviewed and assessed by assessment panel(s) involving members external to the funding body(ies); the research grants are for use in Hong Kong and by researchers of the UGC-funded universities; etc.

Coverage of “On-costs”

4.26 The R-portion is disbursed to the universities as infrastructure funding to enable universities to provide both the staffing and facilities (e.g. accommodation and equipment) necessary to carry out research, and to fund a certain level of research. The definition of “on-costs” has been arousing acute concern in the research sector and the general observation is that it will be more desirable that items to be included as “on-costs” should be clearly defined, in particular on the intangible investments such as staff training, software development, etc. To ensure funding is sufficient to support research, both the time of the researchers involved and the extensive “on-costs” associated with carrying out research project work should be properly identified and funded. As such, a review on the R-portion should cover the issue of “on-costs”.

4.27 Given UGC’s unique role as an independent advisor to the Government on the funding and strategic development of the higher education sector, the UGC is in the best position to conduct a comprehensive and holistic review on the funding mechanism of the R-portion so as to better meet the requirements of the research ecosystem of the universities and to address the concerns of the sector. The scope of the review should cover its purpose, how the allocated funding including the R-portion is deployed within universities, whether “on-costs” are adequately covered, etc.

Recommendation 4

The UGC to conduct a comprehensive and holistic review on the R-portion including the issue of “on-costs” (indirect cost).

Incentivise Cross-institutional / Cross-disciplinary Collaborations

4.28 In Hong Kong, while funding is available for cross-institutional and / or cross-disciplinary collaborative research, joint projects of such nature by far are mostly small-scale and time-limited. As RAE informs funding of individual institutions separately, it is not clearly enunciated in such collaborative projects how the funding allocation and research contributions of individual researchers are being considered at the institutional level. Under the current administrative practices and performance management in individual universities, career advancement of researchers is primarily focused on their performance on individually-based research projects, such as the number of research projects funded by the GRF under the RGC. There is also a general concern that funding support for large-scale research is limited and fragmented in the research sector. Strategies to encourage more joint collaborative research among institutions should be formulated if institutions’ respective research capacity is to be enhanced to secure critical mass and balance across disciplines and sectors of the research community.

4.29 The RGC under the aegis of the UGC has been supporting collaborative academic research in the UGC-funded institutions through various funding schemes, such as the CRF, TRS and AoE. There has also been a suggestion that the UGC should review the above three existing funding schemes and consider the possible combination of them to form a new scheme endeavoured to address the identified needs of the industry and develop potential new market segments delivering economic impact and technology advancement.

4.30 In the course of the review, it is important that the distinct characteristics of the three schemes are well taken into account and preserved such that the existing needs will be duly catered for, and the needs of the research community currently funded by the three schemes will not be undermined. A flexible mechanism should be introduced to allow new schemes to be deployed to support special research of “hot topics of the day” as

well as emerging issues, which may include areas identified by stakeholders, including the Government and the society at large, in a timely manner. As such, there should be no restriction or preference with regard to the discipline for the projects to be funded, but subject to the strategic planning on addressing the challenges facing the society at large in consultation with the Government and universities.

4.31 To incentivise collaborative research projects involving multiple research disciplines and across universities and institutions, the universities / institutions should be encouraged to set up joint, yet stand-alone, research institutes to conduct research topics of strategic and regional importance that are otherwise unattainable by individual universities / institutions and existing funding mechanisms in Hong Kong. This new initiative should be established to fund research institutes set up by universities / institutions, at a substantial level of support to ensure long-term sustainability and social impact to be achieved in a timely manner. These research institutes should also serve as new conduits and nuclei for collaboration and joint projects, which require multiple researchers of different areas of expertise from different universities / institutions and shared core facilities requiring substantial capital investments. These research institutes also provide excellent opportunities for collaboration with the industries and universities / institutions outside Hong Kong. It is recognised, however, the recommendation of setting up large, joint research institutes is not intended to replace individual investigator-driven competitive research nor the so-called curiosity-driven research or other scholarly activities.

Recommendation 5

To incentivise cross-institutional / cross-disciplinary collaborations by providing sustainable support.

The UGC to rationalise and / or review the existing three funding schemes under the RGC targeted for research with substantial impact, i.e. CRF, TRS and AoE, and consider the possible combination of them to form a new scheme to, in addition to catering for the existing needs, support proposals from research institutes set up by universities as well as research incentives of strategic priorities.

Coordination Among Different Research Funding Bodies

Strengthening Coordination of Funding Bodies

4.32 Strong coordination among funding bodies is important to enhance effectiveness and efficiency of resource allocation. The results of a stocktaking exercise conducted by the Task Force on research funding schemes in Hong Kong show that there are a number of entities providing a wide range of funding support in the higher education sector for research at different stages of development. The Task Force recognises the merits of better coordination among different funding bodies to allow the Government to identify strengths and gaps in the research capabilities of Hong Kong, in order to devise new strategies for research funding, thereby maximising resources and alleviating the possibility of resource overlapping. Collaboration of the funding bodies would help achieve a good balance among basic, translational and applied research. It would also save the administrative work to be taken by researchers or research groups such that they do not need to apply funding from various sources at the same time to secure financial resources for a research project.

4.33 The Task Force is therefore of strong opinion that collaboration among different funding bodies be strengthened and enhanced so as to help meet new socio-economic needs and build up a critical mass of research capacity. To enhance coordination and efficiency in overall research funding, the most ideal scenario is to put in place a new research funding regime to consolidate and integrate the various government funding programmes. Given the various funding schemes under the purview of different bodies have divergent natures, aims, components and features, target participants, assessment criteria and variation in funding cycles, integrating all funding schemes into a single research funding regime with such magnitude requires detailed planning and careful considerations to develop an adequate governance structure. It hence should be taken forward by stages and be achieved as a long-term goal.

4.34 To achieve the above goal, consideration should be given to set up a single, overarching research steering council for the purpose. In the course of overseeing Hong Kong's ecosystem on R&D, the proposed overarching body would help formulate high-level quality strategies and advice to balance the objectives of independent scientific discovery and responsiveness to societal needs. It would provide a comprehensive view on the research landscape, and identify strengths and gaps of research needs across the purviews of different funding bodies. The overarching coordinating body should also explore the possibility of standardising the operation procedures of various funding bodies,

such as a single entry point for funding applications, sharing of peer review and monitoring process, and betterment of the research ecosystem in Hong Kong in the long run.

4.35 It is understood that different disciplines have different modes of research that calls for different funding strategies, objectives and peer review process. To cater for such differences, the research steering council should be organised into streams such as biomedical sciences, engineering science or humanities and social sciences. To promote the translation of basic research into innovation and social impact, a vertically-integrated structure that includes basic, translational and applied research under each stream should be created to enable holistic strategy formulation. Increasing vertical integration, in addition to enhancing coordination across funding councils and agencies, has been the focus of the latest reforms on public research funding bodies of leading developed countries, as governments attempt to drive better integration between research and innovation.

4.36 In the interim, it is therefore suggested that an internal government liaison group be established as soon as possible to serve as a platform for various funding bodies to meet regularly and share information on their research directions, latest trends and best practice in administration of funding schemes. Representatives of various funding bodies, including the EPD, FHB, ITC, PICO, RGC, etc., should all be invited to join the liaison group for effective and direct discussion / communication on issues of common interests regarding research policy and funding, or any forms of cooperation such as the establishment of a central database on research.

Recommendation 6

As a start, to strengthen and enhance the coordination among different funding bodies via the setting up of an internal government liaison group to regularly share their research directions and coordinate among them issues of common interests on research.

To consider, in the long run, setting up an overarching research steering council to formulate long-term strategic plan on research and policy on funding; to standardise the operating procedures of various funding bodies to enhance efficiency and effectiveness; and to better integrate research into the innovation ecosystem. To cater for different modes of research among disciplines,

consideration should be given for the council to be organised into streams by major discipline and should vertically integrate basic, translational and applied research to ensure a holistic approach to research funding policy.

Setting up Central Database on Research

4.37 Consistent and unique researcher identifiers would bring about significant benefits, in terms of increased efficiency, transparency and interoperability in the research data landscape. To address the ongoing challenges of accessing comprehensive information on researchers faced by relevant parties, it is suggested that a central data registry be established to capture the updated research profile of each researcher, such as information on publications, projects conducted, grants records, etc., for the benefit of the funding bodies and researchers in the long run.

4.38 Subject to RGC's further deliberation and agreement, a common researcher identity, namely the Open Research Contributor ID (ORCID)⁶, will be adopted for RGC grants applications starting from the 2018/19 cycle. Following the in-principle support by Heads of UGC-funded universities upon consultation, UGC has decided to formally adopt the ORCID as a mandatory requirement in the RAE 2020. In the light of the increasing reference value of researcher ID, the call for a central registry on researchers becomes imminent. It is believed that the creation of a common database on researchers will also facilitate the peer review process. Upon the availability of such a common database, the reviewers can make use of the database for access to the background and track record of researchers more readily. It may also serve to promote the societal importance of research to the public by promoting successful and impactful research accomplished by our higher education sector, in addition to the achievements of individual researcher.

4.39 In anticipation of the growing reference value of researcher ID, there is a need in the long run to set up a central archive on research to serve as a depository of information on researchers, reviewers, projects, application, grants records, etc. The availability of a central database on research will bring about significant benefits, in terms of increased efficiency, transparency and

⁶ The ORCID is a free unique identifier that can connect the researcher and his/her research outputs throughout his/her career. It provides common database or registry service on its website with free search engine on researchers using their names or ORCID ID. All the UGC-funded universities have already registered as member organizations of ORCID and are promoting the use of ORCID ID in their respective institutional repositories. It is also widely used in overseas jurisdictions.

interoperability in the research data landscape. It will also facilitate capacity mapping and hence enhance collaboration among funding bodies, academics, universities and the industries. Limited access may be granted to users for a variety of purposes as suggested above, careful deliberation and design of the database would be required in due course.

Recommendation 7

To adopt a common researcher identity, e.g. the Open Research Contributor ID (ORCID), for grants applications.

In the long run, to set up a central database on research to serve as a depository of information on researchers, reviewers, projects, application and grants records for the benefit of the funding bodies and researchers.

Chapter 5 Invitation of Views

Summary of Recommendations for Consultation

5.1 To assist the Task Force with its further deliberations, we are inviting views from the stakeholders on the preliminary recommendations as set out in Chapter 4 of this Interim Report for Consultation. For easy reference, the recommendations with cross reference to the guiding principles adopted for the review are summarised as follows:

Guiding Principles[#]

Substantial Increase in Research Funding

II

1. All entities including the Government and private sector should join hands to provide new funding to support R&D development with a view to doubling the overall competitive research funding in Hong Kong from the prevailing amount of about \$2 billion to \$4 billion per annum by 2022, including doubling the RGC funding from \$1 billion to \$2 billion over the same period.

As far as the higher education sector is concerned, competitive research funding may be increased via the following means:

II, IV

- 1a. to inject substantial new funds into the REF to make up the shortfall due to the reduction in the annual rate of return, in order to sustain the current funding for research,

II, IV

- 1b. to rationalise the use of different pots of REF for more effective and flexible deployment of funding resources, and

[#] Guiding Principles for Research

- I. High Quality Research with Social Impact
- II. Adequate Support for Funded Research
- III. Balance among Basic, Translational and Applied Research
- IV. Funding for Both Large-scale Programmes and Individual Projects
- V. High Quality Peer Review
- VI. Collaboration and Coordination among Research Funding Bodies
- VII. Sustainable Strategies and Support for Research Talent and Infrastructure
- VIII. Diversified Funding Sources to Include Private, Industrial and Philanthropic Support

- 1c. To boost private R&D expenditure and donations in the research community by setting up a Research Matching Grant Scheme for local degree-awarding institutions;

Sustainable Strategies and Support for Research Talent

- I, VII 2. to strengthen the research staff force and to nurture / sustain the development of research talent by introducing three fellowship schemes, namely a postdoctoral fellowship scheme, a research fellow scheme and a senior research fellow scheme under the RGC;

Support for Research Infrastructure

- I, V, VII 3. RGC's Review (Phase II) to include technical aspects such as time / commitment of Principal Investigators, quality of assessment, monitoring processes and project renewal;
 - II, VII 4. the UGC to conduct a comprehensive and holistic review on the R-portion including the issue of "on-costs" (indirect cost);
 - I, VII 5. to incentivise cross-institutional / cross-disciplinary collaborations by providing sustainable support;
- I, III, IV the UGC to rationalise and / or review the existing three funding schemes under the RGC targeted for research with substantial impact, i.e. CRF, TRS and AoE, and consider the possible combination of them to form a new scheme to, in addition to catering for the existing needs, support proposals from research institutes set up by universities as well as research incentives of strategic priorities;

Coordination Among Different Research Funding Bodies

- VI 6. as a start, to strengthen and enhance the coordination among different funding bodies via the setting up of an internal government liaison group to regularly share their research directions and coordinate among them issues of common interests on research;
- III, V, VI to consider, in the long run, setting up an overarching research steering council to formulate long-term strategic plan on research and policy on funding; to standardise the operating procedures of various funding bodies to enhance efficiency and effectiveness; and to better integrate research into the innovation ecosystem;
- VI 7. to adopt a common researcher identity, e.g. the Open Research Contributor ID (ORCID), for grants applications; and
- VI in the long run, to set up a central database on research to serve as a depository of information on researchers, reviewers, projects, application and grants records for the benefit of the funding bodies and researchers.

Invitation of Views and Comments

5.2 The Task Force welcomes views from stakeholders and members of the public on its preliminary recommendations regarding research policy and funding as listed above. All views and comments will be taken into account when the Task Force formulates its final recommendations for inclusion in a Review Report to be presented to the Government in September 2018.

5.3 Any person who would like to submit views and comments in response to this consultation should do so in writing⁷ by post, email or fax to the UGC Secretariat on or before 10 July 2018. Late provision of views will not be incorporated in the Review Report.

⁷ Please refer to page 2 of this Interim Report for details of submission of views and comments.

Task Force on Review of Research Policy and Funding

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**Dr Armour was an ex-officio member of the Task Force in his capacity as Secretary-General, UGC Secretariat up to 31 December 2017. He serves as a member of the Task Force afterwards.*

Research Funding Schemes in Other Jurisdictions

Mainland

In Mainland, major research funding is provided by the National Natural Science Foundation of China (NSFC) and the Ministry of Science and Technology while the Chinese Academy of Sciences and Chinese Scholarship Council mainly provides fellowship programmes or awards to nurture scientists and academics. The NSFC is the largest Chinese research funding agency for basic research and application-oriented research in the natural sciences and is directly under the jurisdiction of the State Council. In 2016, the total funding for supporting all projects / programmes amounted to RMB¥2.68 billion (~HK\$3.18 billion).

Australia

2. In Australia, there are two major funding bodies, namely the Australian Research Council (ARC) and the National Health and Medical Research Centre (NHMRC). The ARC is a Commonwealth entity and advises the Australian Government on research matters, administers the National Competitive Grants Programme (NCGP), a significant component of Australia's investment in R&D, and has responsibility for Excellence in Research for Australia (ERA) (Australia's national research evaluation framework which identifies / promotes excellence across the full spectrum of research activity in Australia's higher education institutions). The ARC supports fundamental and applied research and research training through national competition across all disciplines. In addition, the ARC brokers partnerships between researchers and industry, government, community organisations and the international community. The NHMRC is Australia's major funding body for research across the full spectrum of health and medical research, from basic science through to clinical, public health and health services research. The funding from the ARC and NHMRC puts much emphasis in partnership between researchers and industry and community organisation as well as international community and are featured with research for indigenous development.

Canada

3. There are three major Canadian Federal granting agencies in Canada, namely the Social Sciences and Humanities Research Council (SSHRC), Natural Sciences and Engineering Research Council of Canada (NSERC) and Canadian Institutes of Health Research (CIHR). SSHRC is the federal research funding

agency that promotes and supports postsecondary-based research and research training in the humanities and social sciences. It is governed by a council appointed by the federal government to represent the interests of the academic, public and private sectors. The main categories of funding programmes under the SSHRC include the Insight Programme, Connection Programme and Talent Programme. The major feature of the Connection Programme is the partnership grants which provide support to foster collaboration between researchers and public, private or the non-profit sector.

Singapore

4. In Singapore, The National Research Foundation (NRF), a department within the Prime Minister's Office, sets the national direction for R&D by developing policies, plans and strategies for research, innovation and enterprise. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent. NRF is the secretariat to the Research, Innovation and Enterprise Council (RIEC) chaired by the Prime Minister. It is the main governmental organisation providing funding on a competitive basis to universities and coordinating different national research agencies. Under the RIEC, there are a number of key government agencies and R&D funding bodies, including Singapore Economic Development Board (provides funding support for companies to conduct R&D), Standards, Productivity and Innovation Board (SPRING) (focus on helping SMEs improve their technological capabilities, and encouraging the growth of the start-up ecosystem), Agency for Science, Technology and Research (A*STAR) (performs economically-oriented R&D to support companies), Academic Research Division of Ministry of Education (ARD of MoE) (formulates, implements and reviews academic research and research manpower policies and funding under the RIE Masterplan for the universities, polytechnics and the Institute of Technical Education) and the National Medical Research Council (provides research funds to healthcare institutions and awards competitive research funds for individual projects). The types of funding include individual research, mid-stream research, joint research schemes and fellowship programmes. The A*STAR, one of the largest public research funders under the Ministry of Trade and Industry, has an explicit mission to bridge the gap between academia and industry and to drive mission-oriented research that advances scientific discovery and technological innovation. The agency has 18 research institutes and several consortia.

5. In view of the need to build up its community of home-grown researchers and thought leaders in social science and the humanities, the government in Singapore set up the Social Science Research Council (SSRC) in 2016. The SSRC, led by former head of civil service and supported by the

ARD of MoE with a funding of SGD350 million (~HK\$2.1 billion), serves as a focal point of efforts with concerted direction to develop talent and strengthen social science and humanities research that benefits social and economic development in Singapore and the region. The Social Science Research Thematic Grant, under the purview of SSRC, encourages high-quality and impactful social science and humanities research in areas of strategic relevance to Singapore.

EU

6. Established by the European Commission, Horizon 2020 is the EU Framework Programme for Research and Innovation with nearly €80 billion (~HK\$732.56 billion) of funding available over 7 years (2014 to 2020). It is based on the idea of bringing together all of the previous EU's research and innovation funding programmes under one common strategic framework. The programmes include the following:

- (a) Excellent Science - to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale.
- (b) Industrial Leadership - to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies.
- (c) Societal Challenges - to reflect the policy priorities of the Europe 2020 strategy and address major concerns shared by citizens in Europe and elsewhere. A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake.
- (d) Spreading Excellence and Widening Participation - to fully exploit the potential of Europe's talent pool and ensure that the benefits of an innovation-led economy are maximised and widely distributed across the EU.
- (e) Science with and for Society - to build effective cooperation

between science and society, to recruit new talent for science and to pair scientific excellence with social awareness and responsibility. To this end, a series of programmes are to be conducted under the approach of “Responsible Research and Innovation”.

- (f) Focus Areas - to focus efforts on fewer topics with bigger budgets to directly support the Commission’s political priorities. Four focus areas have a combined budget of €7 billion (~HK\$64.09 billion): (i) Building a low-carbon, climate resilient future, (ii) Connecting economic and environmental gains - the Circular Economy, (iii) Digitising and transforming European industry and services, and (iv) Boosting the effectiveness of the Security Union.
- (g) European Institute of Innovation and Technology (EIT) - an independent EU body set up in 2008 to enhance Europe’s ability to innovate by nurturing entrepreneurial talent and supporting new ideas. Together with its Knowledge and Innovation Communities (KICs), the EIT creates favourable environments for creative thoughts to enable world-class innovation and entrepreneurship to thrive in Europe. The EIT brings together the “knowledge triangle” of business, education and research to form dynamic cross-border partnerships.
- (h) Euratom - to pursue nuclear research and training activities with an emphasis on continually improving nuclear safety, security and radiation protection, notably to contribute to the long-term decarbonisation of the energy system in a safe, efficient and secure way.

7. The European Research Council (ERC) is part of the Horizon 2020 programme. It has around €13 million (~HK\$119.04 million) of funding available for funding schemes addressing young and senior individual researchers or small groups of individual researchers. The objective is to promote excellence in research by funding frontier research, cross-disciplinary proposals and pioneering ideas in new and emerging fields which introduce unconventional and innovative approaches. There is one call per year for each ERC grant as follows:

- (a) “Starting Grants” - for young, early-career top researchers (2-7 years after PhD) and up to €1.5 million (~HK\$13.73 million) for a period of 5 years;

- (b) “Consolidator Grant” - for already independent excellent researchers (7-12 years after PhD) and up to €2 million (~HK\$18.31 million) for a period of 5 years;
- (c) “Advanced Grant” - for senior research leaders with significant research achievements in the last 10 years and up to €2.5 million (~HK\$22.89 million) for a period of 5 years; and
- (d) “Proof of Concept Grants” - for ERC grant holders who want to check the market and / or innovation potential of research results from ERC projects and up to €150,000 (~HK\$1.37 million) for a period of 12 months.

UK

8. In the UK, UK Research and Innovation (UKRI) brings together the seven Research Councils (RCs), Innovate UK and a new organisation, Research England. The seven RCs are Arts and Humanities Research Council (AHRC), Biotechnology and Biological Sciences Research Council (BBSRC), Engineering and Physical Sciences Research Council (EPSRC), Economic and Social Research Council (ESRC), Medical Research Council (MRC), Natural Environment Research Council (NERC) and Science and Technology Facilities Council (STFC). Each year the RCs invest around £3 billion (~HK\$31.08 billion) in research covering the full spectrum of academic disciplines from medical and biological sciences to astronomy, physics, chemistry and engineering, social sciences, economics, environmental sciences and the arts and humanities. Some research funding schemes such as the Transformative Research Technologies Funding are coordinated by several Councils. Innovate UK is the UK's innovation agency sponsored by the Department for Business, Energy & Industrial Strategy. It drives productivity and growth by supporting businesses to realise the potential of new technologies, develop ideas and make them a commercial success.

9. Research England is a new council within UKRI, operating from April 2018. As a key component of the research funding system, Research England will oversee UKRI's England-only functions in relation to university research and knowledge exchange. This includes providing grant funding to English universities for research and knowledge exchange activities; developing and implementing the Research Excellence Framework in partnership with the UK Higher Education funding bodies; overseeing the sustainability of the Higher Education research base in England; overseeing the £900 million (~HK\$9.324 billion) UK Research Partnership Investment Fund; and the Higher Education

Innovation Fund (HEIF).

USA

10. The USA is one of the jurisdictions with large investment in research and innovation. It maintains universities, researchers and facilities through an extensive network of federal funders, state funders, industry, foundations and university endowments. The federal government funds about 60% of university-based R&D. Academic institutions fund more than 20% of the total share of university R&D as they are increasingly using their own resources to finance research. The rest of research funding comes from industry, private foundations and state / local governments. USA researchers are now more relying on the financial support from private foundations and their own institutions. Nevertheless, the federal government is still the major funding provider to universities.

11. The National Institutes of Health (NIH), a part of the USA Department of Health and Human Services, is one of the largest public funders of biomedical research in the world, investing more than US\$32 billion (~HK\$250.16 billion) a year to enhance life and reduce illness and disability. There are currently 1 323 active funding opportunities available under the NIH. The main types of grant funding provided are (a) research grants, (b) resource grants, (c) programme project / center grants, (d) Trans-NIH programmes, (e) research training and fellowships and (f) career development awards.

12. For research grants, they include the following programmes:

- (a) Research Programme - to support a discrete, specified and circumscribed research project for a period of three to five years with no specific funding limit;
- (b) Small Grant Programme - to support a variety of types of projects like pilot or feasibility studies, collection of preliminary data, secondary analysis of existing data, small and self-contained research projects, development of new research technology, etc. for up to two years;
- (c) Support for Conferences and Scientific Meetings - to support high quality conferences / scientific meetings related to NIH's scientific mission and / or public health with a project duration of up to five years;

- (d) Exploratory / Developmental Research Grant Award - to support the early stage of new, exploratory and developmental research projects, including pilot and feasibility studies with a maximum funding of US\$0.275 million (~HK\$2.14 million) for a period of up to two years; and
- (e) Small Business Technology Transfer - to stimulate scientific and technological innovation through cooperative research / R&D carried out between small business concerns (SBCs) and research institutions (RIs) and foster technology transfer between SBCs and RIs with a funding amount ranged from US\$0.15 million (~HK\$1.17 million) to US\$1 million (~HK\$7.82 million) for a period of up to 2 years.

13. The National Science Foundation (NSF) is one of the federal agencies funding research and education in the field of science and engineering through grants and cooperative agreements with more than 2 000 colleges, universities, K-12 school systems, businesses, informal science organisations and other research organisations throughout the USA. The NSF accounts for about one-fourth of federal support to academic institutions for basic research. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The NSF also supports cooperative research between universities and industry, USA participation in international scientific and engineering efforts, and educational activities at every academic level.

R&D Expenditure by Performing Sector

Year	R&D Expenditure				
	Business sector	Higher education sector	Government sector	Total	
	(HK\$ Mn) (% of total GDE)	(HK\$ Mn) (% of total GDE)	(HK\$ Mn) (% of total GDE)	(HK\$ Mn)	Ratio to GDE (%)
2011	6,194 (0.32%)	7,155 (0.37%)	596 (0.03%)	13,945	0.72
2012	6,647 (0.33%)	7,576 (0.37%)	592 (0.03%)	14,816	0.73
2013	7,017 (0.33%)	7,984 (0.37%)	612 (0.03%)	15,613	0.73
2014	7,437 (0.33%)	8,632 (0.38%)	658 (0.03%)	16,727	0.74
2015	7,994 (0.33%)	9,551 (0.40%)	726 (0.03%)	18,271	0.76
2016	8,528 (0.34%)	10,271 (0.41%)	914 (0.04%)	19,713	0.79

Source: "Hong Kong Innovation Activities Statistics (2014-2016 Edition)", Census & Statistics Department