

For discussion
on 19 June 2018

**Legislative Council
Panel on Commerce and Industry**

**Progress Report on Research & Development Centres
for 2017-18**

PURPOSE

This paper provides an annual update on the 2017-18 operation of the five Research and Development (“R&D”) Centres under the purview of the Innovation and Technology Commission (“ITC”).

BACKGROUND

2. The Government has set up five R&D Centres to drive and co-ordinate applied R&D in selected focus areas. The five Centres are –

- (a) Hong Kong Applied Science and Technology Research Institute (“ASTRI”), designated as the R&D Centre for Information and Communications Technologies;
- (b) Nano and Advanced Materials Institute (“NAMI”);
- (c) Logistics and Supply Chain MultiTech R&D Centre (formerly known as Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies) (“LSCM”);
- (d) Hong Kong Research Institute of Textiles and Apparel (“HKRITA”); and
- (e) Automotive Parts and Accessory Systems R&D Centre (“APAS”).

3. In December 2015, the Finance Committee (“FC”) of the Legislative Council approved an additional allocation of \$677.6 million from the Innovation and Technology Fund (“ITF”) to support the operation of the R&D Centres up to 31 March 2021 (except ASTRI since its operating expenditure is met separately from Government’s annual recurrent subvention). Since 2006, a total commitment of \$1,696.6 million has been approved to fund the operation of the four R&D Centres.

4. The R&D Centres play an important role in creating a vibrant innovation and technology (“I&T”) ecosystem. They act as a focal point for technology collaboration among the Government, industry, academia and research sectors. The R&D Centres not only contribute to the applied research in key areas, but also work closely with the industry to encourage investment in R&D in Hong Kong for promoting applied research, and drive the commercialisation of R&D results.

5. Moreover, the R&D Centres promote the adoption of local technology products and services through active participation in the Public Sector Trial Scheme (“PSTS”). Throughout the years, the R&D Centres have nurtured a lot of research talent and received numerous international awards for their innovations, making significant contribution in consolidating the capabilities of local scientific research teams.

WORK OF R&D CENTRES IN 2017-18

6. At the Panel meetings on 21 June 2016 and 20 June 2017, we briefed Members on the adoption of some new performance indicators for assessing the performance of the R&D Centres. We have adopted these indicators in 2017-18. Information on the work and performance of the R&D Centres is set out in the ensuing paragraphs and at **Annex A** to **Annex E**.

Operating Expenditure

7. The operating expenditure of the R&D Centres in 2017-18 and their staffing situation (as at end-March 2018) are summarised as follows –

Table 1: Operating Expenditure and Number of Staff

	Operating Expenditure (\$ million)		% change	Number of Staff as at End-March 2018
	2016-17	2017-18		
ASTRI	144.8	139.6	-4%	617
NAMI	52.7	65.6	+24%	223
LSCM	27.1	29.5	+9%	96
HKRITA	31.4	34.3	+9%	59
APAS	17.7	16.4	-7%	29

8. In 2017-18, the operating expenditure(s) of –
- (a) ASTRI is largely similar to that of 2016-17;
 - (b) NAMI has increased by 24% because additional expenditure has been incurred for relocating its office and laboratories to the Hong Kong Science Park;
 - (c) LSCM and HKRITA have both increased by 9% because they have filled some vacant R&D positions; and
 - (d) APAS has decreased by 7% due to lower expenditure on staffing and equipment.

Level of Industry Income

9. As the R&D Centres are platforms for coordinating applied research and facilitating technology transfer to the industry, it is important to gauge the level of support of the industry in their work. On top of the industry contribution for their R&D projects, a new indicator on the level of industry income of the R&D Centres which also cover income arising from licensing/royalty and contract services, and other income, has been adopted with a target of 30%¹ from 2017-18 onwards.

10. The performance of the R&D Centres in 2017-18 as compared with 2016-17 is summarised as follows –

Table 2: Level of Industry Income ^(Note)

	2016-17	2017-18	Difference (Percentage Point)
ASTRI	39%	33%	-6
NAMI	55%	53%	-2
LSCM	28%	40%	+12
HKRITA	29%	30%	+1
APAS	54%	47%	-7

Note: The level of industry income is calculated as follows –

$$\frac{\text{Industry Contribution Pledged} + \text{Other Sources of Financial Contribution Pledged} + \text{Commercialisation Income Received}}{\text{Approved Project Expenditure}} \times 100\%$$

¹ A target of 20% was set for the level of industry contribution before 2017-18.

11. In 2017-18, the performance, in terms of the level of industry income, of –

- (a) ASTRI and APAS have decreased by 6 and 7 percentage points respectively because they have initiated a number of larger-scale platform projects² to benefit the wider industry;
- (b) NAMI and HKRITA are largely similar to that of 2016-17; and
- (c) LSCM has improved by 12 percentage points mainly because it has received more commercialisation income.

12. In general, we consider the performance of the R&D Centres in 2017-18 satisfactory in this aspect as they all reached the target level of industry income of 30%.

13. During the discussion of “Injection into the Innovation and Technology Fund” at the Panel meeting on 20 March 2018, we proposed to relax the requirement for R&D Centres to return their commercialisation income to the ITF. We will seek FC’s approval for the proposal in this financial year. Subject to FC’s endorsement, we plan to allow R&D Centres to retain their commercialisation income for use in strategic activities, such as technology and market analyses, infrastructure building, staff development or experimental projects etc., so as to further incentivise commercialisation of R&D results.

² The industry contribution of platform projects should be at least 10% of the project cost. The industry sponsor(s) will not own the project IP. Since February 2014, the industry contribution requirement for projects initiated by Government bureaux/departments and/or statutory bodies with clear community benefits has been waived.

R&D Projects and Expenditure

14. The numbers of R&D projects of the five Centres in 2017-18 and 2016-17 are summarised below –

Table 3: No. of New Projects
and On-going Projects as at end-March 2018

	No. of New Projects Commenced			No. of On-going Projects		
	2016-17	2017-18	% change	As at Mar 2017	As at Mar 2018	% change
ASTRI	38	45	+18%	62	63	+2%
NAMI	45	41	-9%	86	78	-9%
LSCM	18	21	+17%	37	38	+3%
HKRITA	18	21	+17%	59	52	-12%
APAS	16	13	-19%	44	47	+7%
Total	135	141	+4%	288	278	-3%

15. In 2017-18 –

- (a) ASTRI has commenced 45 new projects, representing an increase of 18%, because it has conducted more platform projects to benefit the wider industry;
- (b) NAMI and APAS have commenced 41 and 13 new projects, which have decreased by 9% and 19% respectively, since they have dedicated more efforts on larger-scale projects to develop and validate industry-wide technologies; and
- (c) Both LSCM and HKRITA have commenced 21 new projects, representing an increase of 17%.

16. The total project cost of the new projects commenced by the R&D Centres is about \$839 million in 2017-18, representing an increase of 37% compared with \$612 million in 2016-17. Among these projects, many are collaborative projects which require industry contribution of at least 30% of the project cost. The industry sponsor(s) of these projects will be entitled to utilise the intellectual property (“IP”) rights arising from the projects exclusively for a defined period or own the project IP. A summary of these projects is as follows –

Table 4: No. of New Collaborative Projects and On-going Collaborative Projects as at end-March 2018

	No. of New Collaborative Projects Commenced			No. of On-going Collaborative Projects		
	2016-17	2017-18	% change	As at Mar 2017	As at Mar 2018	% change
ASTRI	4	2	-50%	7	6	-14%
NAMI	33	20	-39%	51	41	-20%
LSCM	3	3	0%	4	5	+25%
HKRITA	5	5	0%	15	13	-13%
APAS	3	3	0%	16	15	-6%
Total	48	33	-31%	93	80	-14%

17. In 2017-18, the R&D Centres have commenced a total of 33 collaborative projects, which has decreased by 31% compared with 48 projects in 2016-17. This is mainly because ASTRI and NAMI have focused on a number of larger-scale platform projects in 2017-18 to benefit the wider industry.

18. Many of the on-going projects involve industry contribution (both in cash or in-kind) and participation, demonstrating the relevancy of the projects to the industry. Two new indicators, namely the number of on-going R&D projects involving industry participation and the number of companies participating in the R&D projects, are shown as follows –

Table 5: No. of On-going Projects involving Industry Participation and Companies participating in On-going Projects as at end-March 2018

	No. of On-going Projects involving Industry Participation			No. of Companies participating in On-going Projects		
	As at Mar 2017	As at Mar 2018	% change	As at Mar 2017	As at Mar 2018	% change
ASTRI	33	42	+27%	69	91	+32%
NAMI	64	51	-20%	81	68	-16%
LSCM	17	15	-12%	55	56	+2%
HKRITA	39	41	+5%	93	89	-4%
APAS	23	24	+4%	38	41	+8%
Total	176	173	-2%	336	345	+3%

19. The performance of both indicators is largely similar to that of last year.

20. As regards R&D expenditure, the situation is as follows –

Table 6: R&D Expenditure (\$ million)

	2016-17	2017-18	% Change
ASTRI	268.0	315.3	+18%
NAMI	92.4	105.5	+14%
LSCM	83.3	90.6	+9%
HKRITA	41.8	65.1	+56%
APAS	34.2	47.6	+39%
Total	519.7	624.1	+20%

21. In 2017-18, the total R&D expenditure of the R&D Centres has increased by 20% due to the commencement of more larger-scale projects of higher project cost. As at end-March 2018, the five R&D Centres had a total of 278 projects still on-going, largely similar to that of 2017-18.

22. Other performance indicators of the R&D Centres, namely the number of organisations benefitting from the PSTS, the number of interns engaged and the number of patents filed, are set out at **Annex A** to **Annex E**.

23. It should be noted that while the figures for a particular year are useful for understanding the work of the R&D Centres, year-on-year variations are normal due to –

- (a) short-term fluctuations in market demand and economic situation which may affect the negotiations/discussions of the R&D Centres with their industry partners/sponsors;
- (b) the need of the R&D Centres to conduct platform and seed projects³ to support the wider industry or build up its research capabilities from time to time; and
- (c) the wish of the R&D Centres to deliver certain public missions, such as the application of their technologies in the public sector, which may affect their short-term income indicators.

REPORT ON INDIVIDUAL CENTRES

24. The ensuing paragraphs will highlight the key activities of each R&D Centre.

ASTRI

25. In 2017-18, ASTRI commenced 45 new projects, comprising 23 platform projects, 2 collaborative projects and 20 seed projects. The amount of industry income has increased from \$89.9 million in 2016-17 to \$117.7 million in 2017-18, with an increase of about 31%, demonstrating ASTRI's continual progress in commercialisation and technology transfer.

26. ASTRI has been working closely with the industry on the following areas –

- (a) *Financial Technologies (“FinTech”)*: In 2017-18, ASTRI has made significant progress in the areas of cybersecurity, blockchain and big data analytics. For example, ASTRI launched an enhanced Cybersecurity Intelligence Sharing Platform with the Hong Kong Association of Banks (HKAB) in March 2018 for HKAB's

³ Seed projects are more forward-looking and exploratory projects that aim to provide foundation work for future platform/collaborative projects. No industry contribution is required for seed projects. The funding amount is capped at \$2.8 million per project.

members, Hong Kong Police Force and Hong Kong Monetary Authority (HKMA) to share intelligence related to the latest cyber threats and defensive solutions.

In Blockchain technology, ASTRI created and demonstrated a Proof-of-Concept Know-Your-Client Distributed Ledger Technology (DLT) banking application, and supported the publication of HKMA's second version of the DLT white-paper in October 2017;

- (b) *Intelligent Manufacturing:* ASTRI has focused its R&D in the areas of intelligent machine vision, smart power and energy, cyber-physical systems and Internet-of-Things (“IoT”) sensing. In 2017-18, ASTRI developed 3D scanning and 3D object recognition technologies for industry robot to realise random bin picking function. These technologies have been adopted in a vision system for automated quality inspection and robot guidance which won the 2017 Hong Kong Awards for Industries. ASTRI has also developed the world's first 3D integrated power module with superior power conversion efficiency and stable output voltage, which were being considered by some leading enterprises in the field for further commercialisation;
- (c) *Next Generation Network:* In 2017-18, ASTRI continued to develop advanced 4G+/5G technologies to help its partners drive commercialisation. For example, a leading telecommunications enterprise has adopted ASTRI's advanced broadband wireless communications technology in launching new generation flying base stations for mission critical mobile communication applications. Besides, in collaboration with a leading telecom service provider in Hong Kong and a world renowned telecom equipment vendor, ASTRI has conducted R&D on the Cellular Vehicle-to-Everything (C-V2X) technology to address road safety scenarios in Hong Kong, where the system can detect threats with low latency. Together with a world leading telecommunication equipment company, ASTRI has also supported the Communications Authority in a spectrum allocation study for future 5G services;

- (d) *Health Technology*: ASTRI has continued its R&D on medical imaging using deep learning technologies. In 2017-18, a handheld video laryngoscope was developed in partnership with one of the world's largest medical device manufacturers. A computer-aided diagnosis system for cytology-based cervical cancer screening was developed and transferred to customers for commercialisation; and
- (e) *Smart City*: ASTRI's Smart Water IoT System has been deployed in the Mainland and is being tested in Hong Kong by the Water Supplies Department. ASTRI has also developed a biometric access control system using palm fusion biometric sensing devices for security applications. Both systems won awards in the 2017 Asia Pacific ICT Alliance Awards and the Hong Kong ICT Awards 2018.

ASTRI's IoT software systems for smart indoor and outdoor Geographic Information System which support smart parking and seamless navigation for pedestrians were developed and tested in Kowloon East in mid-2017. In collaboration with the Hong Kong Science and Technology Parks Corporation, ASTRI also set up the Smart City Innovation Centre in July 2017 to create collaborative innovative networks for smart city development in Hong Kong.

27. Furthermore, in 2017-18, ASTRI established two new joint R&D centres and laboratories with major partners for talent development, R&D and commercialisation of project outcomes.

NAMI

28. In 2017-18, NAMI commenced 41 new projects, comprising 6 platform projects, 20 collaborative projects, 12 seed projects and 3 projects under the PSTS. The total project cost of the new R&D projects commenced has increased by 13% from \$125.2 million in 2016-17 to \$141.9 million in 2017-18.

29. NAMI has continued to build on its core platform technologies and drive commercialisation to support the development of new applications for the industry. Examples include –

- (a) *Nanofiber Technologies:* Nanofiber has high pollutant removal efficiency, making it a superior material for filtration. NAMI's nanofiber technologies were adopted by industry sponsors in 2017-18 to develop multifunctional High Efficiency Particulate Air media for air filtration and highly efficient filtration cartridge for water dispenser;
- (b) *Nano-bubble Technologies:* Nano-bubbles are incredibly small, stable cavities of gas/air in liquid. NAMI's nano-bubble technologies were adopted by industry sponsors in 2017-18 to develop system for sanitising water from cooling towers, fountains and swimming pools as well as water treatment system with multiple gas input;
- (c) *Germ-repellent Technologies:* Without using leachable biocides, NAMI has developed an innovative approach for making plastic germ-repellent materials. In 2017-18, the approach was adopted by industry sponsors to develop germ-repellent polyethylene resins suitable for injection and blow molding, and application to paper based materials such as germ-repellent books and food paper boxes. The sponsors have recently launched their products and several germ repellent plastics resins are now available in the market;
- (d) *Ultra-flexible and Super Safe Battery Technology for Wearable Electronics:* NAMI has developed lithium ion batteries using nanofiber sponge electrolyte which is highly flexible, super-safe, powerful and rechargeable. The technology was adopted by an industry sponsor to develop fast rechargeable flexible lithium ion batteries. The industry sponsor has set up a production line and the production prototypes are ready for market launch; and
- (e) *Nanotechnology for Skin Care:* NAMI's nano-carrier technology was adopted by the industry sponsor to develop skin care formulations to enable better skin penetration of active ingredients. Two product lines with four products have been launched to the market earlier this year.

30. NAMI's technologies won a number of international and local awards including 11 gold medals (four awarded with Jury's Commendation) and one special award at the 46th International Exhibition of Inventions of Geneva 2018 ("Exhibition of Inventions of Geneva 2018") as well as a prize at the Construction Industry Council Innovation Award 2017. In 2017, 18 technologies developed by NAMI were commercialised or put under trial production by its industry sponsors. NAMI will continue to work closely with the industry on commercialisation and technology transfer.

LSCM

31. In 2017-18, LSCM commenced 21 new projects, comprising 6 platform projects, 3 collaborative projects, 5 seed projects and 7 projects under the PSTS. The total number of new projects commenced has increased from 18 in 2016-17 to 21 in 2017-18.

32. Examples of the Centre's work on research and technology adoption in 2017-18 include –

- (a) *Smart Airport Initiative*: In collaboration with Airport Authority Hong Kong, LSCM and the Chinese University of Hong Kong have developed a video-based analytics system for airport asset monitoring. The system monitors trolleys' availability and provides real-time alert, thus improving efficiency of managing trolleys at the Hong Kong International Airport. This innovation won a gold medal at the Exhibition of Inventions of Geneva 2018;
- (b) *Smart Mobility*: Embracing the Smart Mobility initiative of the Government, LSCM and the Hong Kong University of Science and Technology have developed a Smart Wi-Fi access-point system for tracking users' indoor location. This enables users to experience better Wi-Fi service and provides better flow analysis and management for public or commercial buildings. This innovation won a silver medal at the Exhibition of Inventions of Geneva 2018;
- (c) *Smart Government*: In partnership with the Lands Department, LSCM and the Hong Kong Polytechnics University have developed a three-dimensional Geodatabase framework for mapping spatial information for indoor and outdoor environment. The framework can be utilised in various applications such as lands and resources surveying, civil engineering and urban planning.

Moreover, LSCM and the University of Hong Kong have developed an IoT-based just-in-time prefabrication housing construction management system in collaboration with the Hong Kong Housing Authority (HA). This platform improves the efficiency of a housing construction life cycle by seamless communication and coordination among multiple stakeholders. The system was successfully put on trial in HA's construction sites and is under further trial at sites of the Hong Kong Housing Society;

- (d) *Community Service for Smart Living*: In collaboration with a social enterprise, LSCM has developed a low-cost elderly tracker and tracking platform that is tailored for caretakers and family members of elderly or patients with dementia. The tracker provides both indoor and outdoor tracking and real-time monitoring on a 24/7 basis. The social enterprise launched a pilot scheme of the tracking platform for the public in January 2018; and
- (e) *Collaboration with Cities in Greater Bay Area*: With the imminent commissioning of the Hong Kong–Zhuhai–Macau Bridge, LSCM is collaborating with the trade declaration authority in Zhuhai to develop an information service platform for cross-border trade declaration. The platform will facilitate importers and exporters to handle goods classification more efficiently when making trade declaration.

33. In addition, LSCM has developed an innovative technology for Ultra-Wide Band applications on solitary activity monitoring and non-invasive object detection. These two applications won a gold medal and a silver medal at the Exhibition of Inventions of Geneva 2018. Looking forward, LSCM will continue to promote technology adoption in both public and private sectors.

HKRITA

34. In 2017-18, HKRITA commenced 21 new projects, comprising 9 platform projects, 5 collaborative projects, 1 seed project and 6 projects under the PSTS. The amount of industry income has increased over 40% from \$19 million in 2016-17 to \$27.4 million in 2017-18, demonstrating its growing support from the industry and progress in commercialisation and technology transfer.

35. HKRITA has continued to collaborate with local research institutes to develop new materials and advanced production technologies for the textiles and apparel industry, as well as to conduct more multi-discipline and industry-driven research projects.

36. In 2017-18, HKRITA has continued to build on its in-house research competence in textile recycling and high-performance textile technologies. In particular, its four-year collaboration with one of the world's largest fashion and design companies led to a series of textile recycling projects. One of these projects developed ground-breaking solutions to recycle blend textiles into new fabrics and yarns through a hydrothermal process, which won the 2017 Hong Kong Green Innovations Awards – Silver Award in the Hong Kong Awards for Environmental Excellence. The technology will be scaled up through in-house researches and made available to the global fashion industry. Other examples of the Centre's R&D work include –

- (a) *Textile Waste Recycling by Biological Method:* HKRITA has developed a novel bioprocess which makes use of textile waste (via the process of pre-treatment, enzymatic hydrolysis and melt-spinning) for the sustainable production of different value-added products, such as glucose, synthetic fibre, bioplastics, bio-chemicals and bio-surfactants. These materials are applicable to a wide range of industries; and
- (b) *Development of a Reusable and Comfort Facemask as a Barrier to Microorganisms:* HKRITA has developed a unique technique to embed magnetic field in facemask in order to provide an effective anti-microbial function. With an ergonomic design, the mask provides improved thermal and next-to-skin comfort of the users. The washable structure and design of the facemask has also significantly extended its lifetime.

37. At the Exhibition of Inventions of Geneva 2018, HKRITA won seven awards including five gold medals, one silver medal and a special prize from The National Research Council of Thailand for the new technology on artificial intelligence based fashion production order prediction system.

38. HKRITA has continued to promote the adoption of R&D outcomes in the public sector. HKRITA has been collaborating with the Hong Kong Sports Institute (HKSI) to facilitate elite athletes in their preparation for the 2018 Asian Games and 2020 Olympic Games. Apart from the design of high performance wheelchair cushions to protect boccia athletes, a trial study is

underway to identify bedding textiles with thermal comfort characteristic for HKSI athletes, enabling them to have better rest during overseas training and competition.

39. In 2017-18, HKRITA has dedicated its efforts on commercialisation and transferring its technologies to the industry. HKRITA signed seven licensing agreements with the industry during the year. It has also initiated or facilitated over 25 technology transfer activities for local companies, a government department and non-governmental organisations.

APAS

40. In 2017-18, APAS commenced 13 new projects, comprising 3 platform projects, 3 collaborative projects, 2 seed projects and 5 projects under the PSTS. The amount of industry income has increased by 175% from \$9.7 million in 2016-17 to \$26.7 million in 2017-18, demonstrating its growing support from the industry.

41. APAS has also been active in collaborating with industrial partners and supporting small and medium enterprises to develop technologies for the local Electric Vehicle (EV) industry. Examples of the Centre's R&D work include -

- (a) *Plug-in hybrid electric coach*: In collaboration with an industry sponsor, APAS has developed a 12 metre plug-in hybrid e-coach, which is equipped with a high quality, safer and fast-charging Lithium Titanate battery pack;
- (b) *16-tonne full-electric truck (e-truck)*: With an industry sponsor, APAS has developed an e-truck, which is equipped with a high performance powertrain system. The system comprises a permanent magnet synchronous motor and automatic gearbox for running on hilly roads in Hong Kong; and
- (c) *EV Portable Charger Kit (PCK)*: APAS has developed a PCK for EVs. The installation and maintenance cost of a PCK Socket is only one tenth of a traditional EV charger, and hence making it more affordable to install sockets in carparks.

42. APAS has put in strong effort to promote commercialisation of its R&D results and transfer technologies to the industry. For example, an electric bus project was completed with the type approval obtained from the Transport Department and the sponsor has already received orders of more than 60 units.

43. APAS has developed a number of technologies which won international awards in 2017-18. APAS won two gold medals with Jury's Commendation at the Exhibition of Inventions of Geneva 2018 for its smart safety seat belt and EV portable charger kit system. APAS also won a gold medal at the 2017 Chinese International Invention Expo for the development of mobilised EV charging service vehicle and combo fast charging station, and a gold award at the Hong Kong Innovative Invention Award 2017 for the development of EV with super-capacitor energy storage system.

44. APAS has developed EV charger and smart-city related technologies for the public sector and industry associations. Two examples are as follows -

- (a) *Multi-standard Mobilised Smart Charger for EVs*: the trial project was developed and fabricated for Hong Kong Automobile Association which provides the city's first emergency roadside charging service for battery-drained electric vehicles; and
- (b) *Smart Vehicle-to-Home (V2H) System for EV*: the system uses EV batteries as energy storage devices for households. It saves electricity cost and helps relieve the high power consumption situation in peak load hours. This V2H system can support the Smart Energy Program, which includes a time-of-use tariff, launched by CLP Power Hong Kong Limited in June 2017.

ADVICE SOUGHT

45. Members are invited to note the latest progress of the R&D Centres.

**Hong Kong Applied Science and Technology Research Institute (“ASTRI”)
Highlight of Operation in 2017-18**

I. New R&D Projects and Industry Contribution (in \$million)

	<u>2016-17</u>			<u>2017-18</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	13	196.7	42.8	23	342.7	83.2
Collaborative	4	36.4	18.3	2	13.0	6.5
Seed	20	53.9	n/a	20	54.9	n/a
Total:	37	287.0	61.1	45	410.6	89.7
Public Sector Trial Scheme	1	5.4	n/a	0	0.0	n/a

II. Operating Expenditure (in \$million)

	2016-17	2017-18
Staffing	77.6	75.4
Accommodation	24.0	26.6
Equipment	3.1	7.2
Others	40.1	30.4
Total:	144.8	139.6

III. Industry Income (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
	Industry Income	Industry Income
Industry Contribution	61.1	89.7
Licensing/Royalty	4.2	7.4
Contract Services	24.7	20.6
Others	0.4	0.2
Total:	90.4 (89.9)	117.9 (117.7)
Project Cost	287.0 (233.1)	410.6 (355.6)
Level of Industry Income:	39%	33%



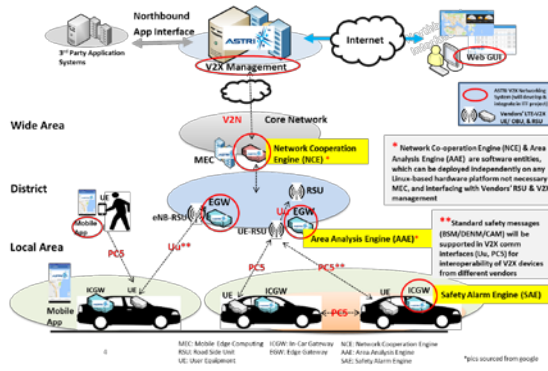
Note: Figures in brackets exclude projects not requiring sponsorship for the purpose of calculating the level of industry income.

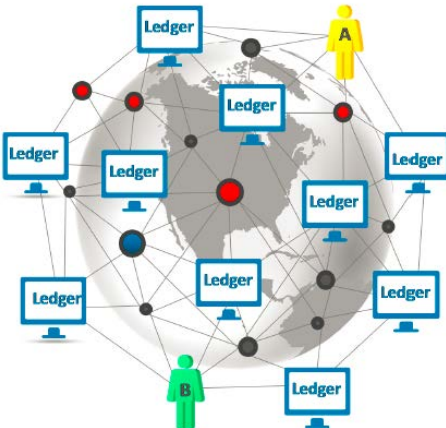
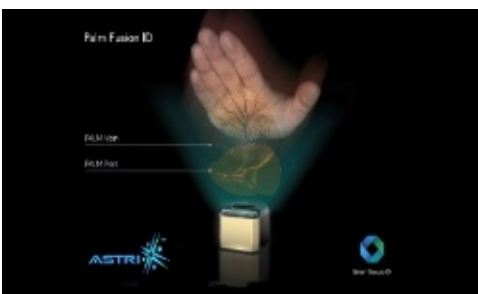
IV. Other Performance Indicators


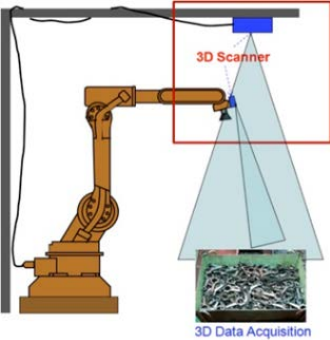
	2016-17	2017-18
Number of Organisations Benefitting from the Public Sector Trial Scheme	9	3
Number of Interns Engaged	38	47
Number of Patents Filed	60(59)	64(53)

Note: Figures in brackets denote the number of patents granted.


V. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p>1. Narrowband-Internet of Things (NB-IoT) Transceiver Technology</p>  <p>The diagram features a central yellow square labeled 'NB-IoT'. It is connected to several blue square icons representing different types of IoT devices: a car, a shopping cart, a washing machine, a refrigerator, a snowflake, a television, a smartphone, a door, a server rack, and a lightbulb.</p>	<p>ASTRI has developed a NB-IoT transceiver technology which supports low power operating modes to become one of the key enabling technologies for smart city.</p> <p>The NB-IoT transceiver technology was licensed to an international integrated circuit company in 2017-18.</p>
<p>2. Cellular Vehicle to Everything (C-V2X) Network System</p>   <p>The collage includes three images: a car's dashboard displaying a 'V2X' logo, a white car on a road, and a car-to-car communication diagram. The network diagram below shows a multi-layered architecture. At the top, '3rd Party Application Systems' connect to 'V2X Management' via a 'Northbound App Interface'. This connects to 'ASTRI' and the 'Internet', which in turn connects to 'Web GUI'. Below this is the 'Wide Area' layer with 'V2N' and 'Core Network'. The 'District' layer includes 'MEC' (Multi-access Edge Computing) and 'Network Cooperation Engine (NCE)'. The 'Local Area' layer shows 'eNB-RSU', 'UE-RSU', 'UE-ICW', 'UE-PCS', and 'UE-ICW'. Key engines shown are 'Area Analysis Engine (AAE)', 'Network Cooperation Engine (NCE)', and 'Safety Alarm Engine (SAE)'. A legend at the bottom identifies components like MEC, ICW, RSU, UE, and various engines.</p>	<p>ASTRI has developed a C-V2X technology, through which vehicles may communicate with one another, pedestrians, and roadside infrastructure to enhance road safety, deliver a better driving experience and support the development of the internet of vehicles (IoV).</p> <p>With the support of the Smart Mobility Consortium, the technology was demonstrated in the Hong Kong Science Park at the Intelligent Transportation System Asia-Pacific Forum 2017. ASTRI licensed the C-V2X network system to a local telecommunication company in December 2017.</p>

Project / Technology	Status / Progress
<p>3. Blockchain Technology</p>  <p>The diagram illustrates a global blockchain network. A central globe is surrounded by several nodes, each represented by a blue box labeled 'Ledger'. These nodes are interconnected by a network of lines. Two human figures, one yellow (labeled 'A') and one green (labeled 'B'), are positioned around the globe, representing participants in the network.</p>	<p><u>HSBC Safeguard App Competition</u></p> <p>ASTRI supported HSBC Safeguard App Competition in December 2017 by building a blockchain-based virtual platform and providing a suite of Application Programming Interfaces for contestants to develop their iOS or Android app prototypes.</p> <p><u>Blockchain-based property loan system</u></p> <p>ASTRI developed a blockchain-based property loan system for a local financial services company in 2017-18.</p> <p><u>Insurance claims</u></p> <p>ASTRI supported a local technology company to apply blockchain technology for handling billing, claims and reimbursement records for the insurance industry in January 2018.</p>
<p>4. Biometric Access Control System</p>  <p>The image shows a hand being scanned by a biometric device. The device is labeled 'Palm Fusion ID' and 'Palm vein'. The hand is positioned over the device, and a blue light is visible. The ASTRI logo is visible in the bottom left corner of the image.</p>	<p>Developed by ASTRI and its Swedish research partner, the Palm Fusion Biometric Access Control System enables fully secure user identity verification. The system was equipped with a sensing device which captures both palm print and palm vein features of users' hands, offering solution for higher security and effective management of personal data.</p> <p>This System won a Gold Award at the Hong Kong ICT Awards 2018.</p>

Project / Technology	Status / Progress
<p>5. Next-Generation Mission Critical Communication System</p> 	<p>ASTRI developed a Long Term Evolution-based broadband trunking communication (B-TrunC) system which provides highly reliable critical communication services. The system offers one-to-many call capacity, low latency, flexible deployment bandwidth and multimedia or high-speed data transmission to strengthen railway signalling, public protection, disaster relief and other mission-critical communication. ASTRI was awarded a Technological Achievement Certificate of Merit for this technology at the 2017 Hong Kong Awards for Industries.</p>
<p>6. 3D Random Bin Picking for Industrial Robot</p> 	<p>To enhance 3D robotic visual perception, ASTRI has developed a highly accurate and high-speed whole-field 3D scanning technology for robotic eyes which can be deployed in a wide range of applications, including 3D random bin picking, pick-and-place, assembly, navigation, body scanning for garment manufacturing, 3D printing, etc. The underpinning 3D computer vision technology won the Equipment and Machinery Design Award at the 2017 Hong Kong Awards for Industries.</p>

Project / Technology	Status / Progress
<p>7. Naked Eye Real-time 3D Conversion</p>  <p><i>ASTRI was invited to witness the ceremony as the key strategic partner of Marvel Digital</i></p>	<p>ASTRI has developed a 3D real-time conversion technology which generates contents for different types of spectacles-free 3D displays. Through its partnership with Marvel Digital, ASTRI's naked eye 3D technology has been adopted by some commercially successful products, such as 3D mosaic walls, 3D phones, 3D flat-panel computer screens and naked-eye displays that are able to deliver ultra-high-definition 4K video content. As the key strategic partner, ASTRI contributed to the listing of Marvel Digital's holding company on Nasdaq in August 2017.</p>
<p>8. Establishment of ICBC (Asia)-ASTRI FinTech Innovation Laboratory</p> 	<p>ASTRI and Industrial and Commercial Bank of China (Asia) Limited (ICBC (Asia)) jointly set up the ICBC (Asia)-ASTRI FinTech Innovation Laboratory in June 2017, which aims to develop latest financial technology (FinTech) applications in banking business and promote the development of FinTech in Hong Kong.</p>
<p>9. Establishment of ASTRI-INL Joint Laboratory</p> 	<p>ASTRI and the International Iberian Nanotechnology Laboratory (INL) set up a joint innovation laboratory in March 2018 to pursue cutting-edge and interdisciplinary research for smart city development. The ASTRI-INL joint laboratory seeks to promote innovative R&D efforts in areas such as smart city and intelligent manufacturing. In addition, the partnership will focus on grooming a new generation of researchers through mutual collaboration.</p>

Project / Technology	Status / Progress
<p>10. Establishment of Smart City Innovation Centre</p> 	<p>ASTRI has partnered with the Hong Kong Science and Technology Parks Corporation to jointly establish the Smart City Innovation Centre (SCIC) which has the state-of-the-art infrastructure to facilitate R&D and innovation for smart city solutions.</p> <p>The SCIC offers a common platform for R&D professionals, technology companies, business enterprises, start-ups and public service providers to develop, test and demonstrate innovative and smart city solutions using IoT, Fintech, 5G and other information and communication technologies.</p>

**Nano and Advanced Materials Institute (“NAMI”)
Highlight of Operation in 2017-18**

I. New R&D Projects and Industry Contribution (in \$million)

	<u>2016-17</u>			<u>2017-18</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	6	29.3	5.7	6	42.6	10.1
Collaborative	33	83.1	42.0	20	62.9	31.7
Seed	4	11.1	n/a	12	33.5	n/a
Total:	43	123.5	47.7	38	139.0	41.8
Public Sector Trial Scheme	2	1.7	n/a	3	2.9	n/a

II. Operating Expenditure (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
Staffing	30.3	34.0
Accommodation	5.9	11.0
Equipment	7.2	6.3
Others	9.3	14.3
Total:	52.7	65.6

III. Industry Income (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
	Industry Income	Industry Income
Industry Contribution	47.7	41.8
Licensing/Royalty	1.9	1.3
Contract Services	13.5	12.4
Others	0.5	1.4
Total:	63.6 (62.0)	56.9 (56.1)
Project Cost	123.5 (112.4)	139.0 (105.5)
Level of Industry Income:	55%	53%



Note: Figures in brackets exclude projects not requiring sponsorship for the purpose of calculating the level of industry income.


IV. Other Performance Indicators



	2016-17	2017-18
Number of Organisations Benefitting from the Public Sector Trial Scheme	17	20
Number of Interns Engaged	33	11
Number of Patents Filed	53(28)	51(46)

Note: Figures in brackets denote the number of patents granted.

V. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p>1. Printable and Flexible Lithium Ion Batteries for Portable Electronic Devices</p> 	<p>NAMI has developed highly flexible, super-safe, powerful and rechargeable lithium ion batteries based on nanofiber sponge electrolyte.</p> <p>The technology has been adopted to develop various products such as fast rechargeable flexible ion battery, printable ultra-safe flexible battery and rechargeable battery for wireless asset tracking tags. An industry sponsor has built a production line with first production prototypes and is ready for customer orders.</p>
<p>2. Development of a Nano-modified Cementitious Waterproof Coating</p> 	<p>NAMI has developed a nano-modified cementitious waterproof coating which has superior waterproof performance with high flexibility and excellent adhesion on the substrates. The coating can be directly applied on damp surface without affecting the bonding strength on concrete surface.</p> <p>The waterproof coating has been commercialised. Since the adoption of the technology by the industry sponsor, the coating has been applied at various sites with an area of over 7 000 square metres.</p>

Project / Technology	Status / Progress
<p>3. Nano-bubble Technologies</p> 	<p>NAMI has developed nano-bubble technologies which won a gold medal in the International Exhibition of Inventions of Geneva 2017. Nano bubbles are incredibly small, stable cavities of gas or air in liquid. They can stay submerged under water for extended periods of time so the gases inside the bubbles can remain effective. The technology was adopted by several industry sponsors in 2017-18 to develop systems for sanitising water from cooling towers, fountains and swimming pools as well as water treatment system with multiple gas input.</p>
<p>4. Rubberised Paving Block</p> 	<p>In collaboration with an industry sponsor, NAMI has developed paving blocks with a higher degree of recycled tire materials.</p> <p>Paving blocks are under trial production by the sponsor and will be put on trial at Kwun Tong Industrial Culture Park.</p>
<p>5. Built-in Biocide-free Plastic Materials Suitable for Injection Molding Process</p> 	<p>Without using leachable biocides, NAMI has developed an innovative approach for making plastics materials repellent to germs and compatible to traditional manufacturing processes like injection molding for application in many areas from food containers to medical products.</p> <p>The technology was adopted to develop food grade germ-repellent products, germ-repellent plastics resins suitable for injection and blow molding, germ-repellent breathing tubes, and germ-repellent varnish for use in paper products.</p> <p>Several germ-repellent plastics resins are available for sale in the market, such as food grade germ-repellent plastics and germ-repellent plastics resins for injection and blow molding.</p>

Project / Technology	Status / Progress
<p>6. Application of Nanotechnology to Enhance Skin Uptake of Hydrophilic Active Ingredients in Skin Care Products</p> 	<p>NAMI has developed four skincare formulations with its proprietary nano-carrier technology to enhance the skin penetration of active ingredients. The nano-emulsion penetrates the outermost dead skin layer and brings active ingredients deep into skin layer where they are most needed.</p> <p>Two different product lines offering four products have been launched in the market.</p>
<p>7. Novel Polyethylene Vinyl Acetate (PEVA) film</p> 	<p>NAMI has developed a new nano formulation to apply a higher ratio of waste recycled materials for PEVA film, resulting in 20% cost reduction of the industry sponsor's existing products of shower film and table sheet. NAMI has transferred the technology to the industry sponsor. Production started in end 2017 and is targeted at the US market.</p>

**Logistics and Supply Chain Management MultiTech R&D Centre (“LSCM”)
Highlight of Operation in 2017-18**

I. New R&D Projects and Industry Contribution (in \$million)

	<u>2016-17</u>			<u>2017-18</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	6	47.8	11.1	6	68.1	7.1
Collaborative	3	5.2	2.7	3	7.3	3.5
Seed	4	10.4	n/a	5	13.7	n/a
Total:	13	63.4	13.8	14	89.1	10.6
Public Sector Trial Scheme	5	14.7	n/a	7	28.0	n/a

II. Operating Expenditure (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
Staffing	16.0	18.8
Accommodation	4.9	7.2
Equipment	0.7	0.4
Others	5.5	3.1
Total:	27.1	29.5

III. Industry Income (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
	Industry Income	Industry Income
Industry Contribution	13.8	10.6
Licensing/Royalty	0.4	0.3
Contract Services	0.6	4.0
Others	-	-
Total:	14.8 (14.7)	14.9 (14.8)
Project Cost	63.4 (53.0)	89.1 (37.0)
Level of Industry Income:	28%	40%

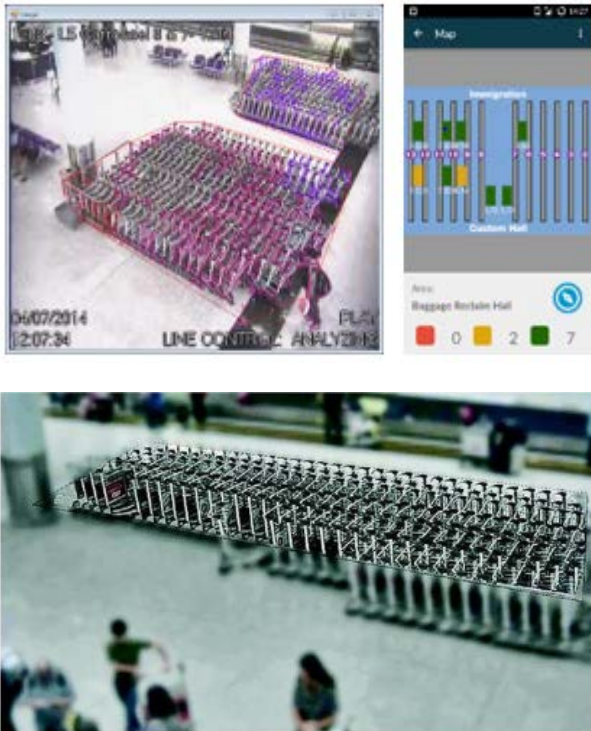

Note: Figures in brackets exclude projects not requiring sponsorship for the purpose of calculating the level of industry income.

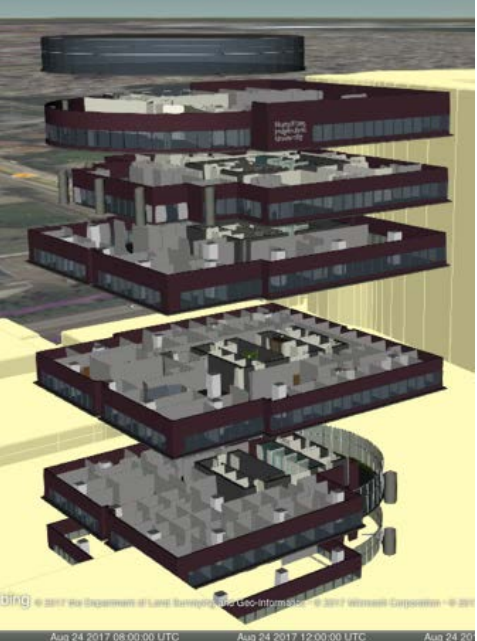

IV. Other Performance Indicators

	2016-17	2017-18
Number of Organisations Benefitting from the Public Sector Trial Scheme	25	27
Number of Interns Engaged	18	20
Number of Patents Filed	16(1)	17(2)

Note: Figures in brackets denote the number of patents granted.

V. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p>1. Video Analytics for Resource Management</p> 	<p>In collaboration with the Airport Authority Hong Kong, LSCM and the Chinese University of Hong Kong has developed a resource management system using video content analytic techniques.</p> <p>Through machine learning and data mining, the system was able to process videos and images to identify the number of trolleys available in the baggage hall of the Hong Kong International Airport. The system provides real-time alert to ground staff for any shortage of trolleys.</p> <p>This application won a gold medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>
<p>2. Smart Access Point: Wi-Fi Positioning and Optimisation for a Smart City</p> 	<p>LSCM and the Hong Kong University of Science and Technology have developed a Smart Wi-Fi access-point (Smart AP) system for tracking user's indoor location.</p> <p>The Smart AP system utilises Wi-Fi signal generated by mobile phones to locate the devices with precision, providing a truly smart Wi-Fi solution for a smart city.</p> <p>The system has been commercialised and deployed in a shopping mall for flow analysis and management. This application won a silver medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>

Project / Technology	Status / Progress
<p>3. Develop 3D Geodatabase Framework for Hong Kong – A Lightweight 3D Seamless Spatial Data Acquisition System</p>  	<p>LSCM has worked with the Hong Kong Polytechnic University and the Lands Department to develop a lightweight 3D spatial data acquisition system and a 3D geodatabase framework for Hong Kong.</p> <p>With the geodatabase framework and spatial data acquisition system, indoor and outdoor urban space can be digitised in 3D format for different smart city applications, such as urban planning, intelligent transport, urban heat analysis, etc.</p> <p>LSCM is working with various government departments and construction companies to evaluate the technologies and explore commercialisation potentials.</p>

Project / Technology	Status / Progress
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4. An affordable Location Tracking System for HK's Elderly, Disabled and Dementia Patients



智愛寶 - 流動應用程式
適用於家人或照顧者

家人即時知道長者所在位置
掌握實時位置

了解長者生活動態
歷史記錄

長者重要的人身安全防線
電子安全圍籬

適合家庭不同的對應照顧方式
單獨照顧多位長者 / 共同照顧一位長者

在需要時可發
遙距響號呼援

智慧科技輔助照顧
健康訊息管理

LSCM has collaborated with a social enterprise to develop an affordable location tracking system for the elderly, disabled and dementia patients.

The system can track the users both indoors and outdoors. Caretakers can monitor their real-time and past locations through a mobile application. The tracker can also send emergency alerts to caretakers and log records on healthcare devices.

The social enterprise rolled out a trial scheme of the tracking system in January 2018, with 1 000 free quota for the needy.

5. HK-Zhuhai Trade Facilitation Platform



In collaboration with the trade declaration authority in Zhuhai, LSCM is developing a trade facilitation platform to connect the logistics industry in Hong Kong with the Zhuhai Electronics Port for import and export trade declaration.

The platform leverages artificial intelligence and big data analytics to recommend classification code for the traded goods. It will reduce the process time for trade declaration and provide more accurate estimation of tax rate.

The platform will facilitate import and export trades in the Greater Bay Area. LSCM is working with various logistics associations to explore commercialisation opportunities.

Project / Technology

Status / Progress

6. RFID-Enabled Building Information Modeling (BIM) Platform

In collaboration with the Hong Kong Housing Authority (HA), LSCM and the University of Hong Kong have developed an IoT-based just-in-time prefabrication housing construction management system.



The system provides real-time construction data and more efficient cross-border prefabrication logistic and supply chain management, enabling better coordination among multiple stakeholders.

The platform has been successfully put on trial in HA's construction sites and is under further trial at sites of the Housing Society.



**Hong Kong Research Institute of Textiles and Apparel (“HKRITA”)
Highlight of Operation in 2017-18**

I. New R&D Projects and Industry Contribution (in \$million)

	<u>2016-17</u>			<u>2017-18</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	10	45.8	7.8	9	77.8	19.0
Collaborative	5	20.1	10.3	5	14.7	7.5
Seed	1	2.7	n/a	1	1.9	*
Total:	16	68.6	18.1	15	94.4	26.5
Public Sector Trial Scheme	2	2.7	n/a	6	6.1	n/a

* amount under \$50,000

II. Operating Expenditure (in \$million)

	2016-17	2017-18
Staffing	18.6	21.0
Accommodation	3.9	4.4
Equipment	2.1	2.6
Others	6.8	6.3
Total:	31.4	34.3

III. Industry Income (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
	Industry Income	Industry Income
Industry Contribution	18.1	26.5
Licensing/Royalty	0.3	0.5
Contract Services	0.3	0.1
Others	0.4	0.7
Total:	19.1 (19.0)	27.8 (27.4)
Project Cost	68.6 (65.9)	94.4 (92.5)
Level of Industry Income:	29%	30%



Note: Figures in brackets exclude projects not requiring sponsorship for the purpose of calculating the level of industry income.

IV. Other Performance Indicators

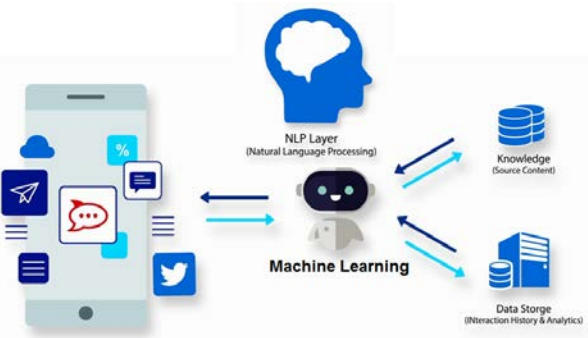
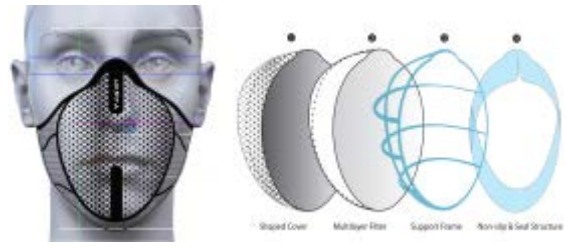
	2016-17	2017-18
Number of Organisations Benefitting from the Public Sector Trial Scheme	32	26
Number of Interns Engaged	51	53
Number of Patents Filed	15(13)	38(9)


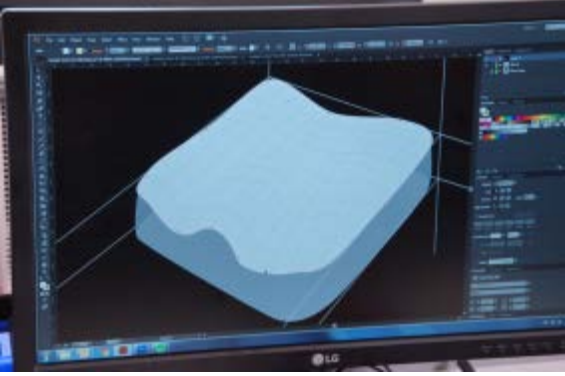
Note: Figures in brackets denote the number of patents granted.

V. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p>1. Hydrothermal Treatment and Dissolution Treatment to Recycle Polyethylene Terephthalate (PET)/Cellulose from the Cotton and PET Blends</p>  	<p>Garments are often made from a blend of different fibres in order to improve fit, style, comfort and longevity. As yet no commercially viable separation and recycling technologies are available in the industry for the most popular blends such as cotton and polyester blends.</p> <p>HKRITA has developed an efficient hydrothermal treatment method to decompose cotton into cellulose powders, hence enabling the separation of the polyester fibres from the blends. The separation process uses only heat, water and less than 5% of green chemical with a recovery rate of over 98% for polyester fibres in 0.5-2 hours. The quality of the polyester fibres is maintained permitting fibre-to-fibre recycling.</p> <p>This technology won a gold medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>

Project / Technology	Status / Progress
<p>2. Upcycling and Processing of Used Mixed Blend Apparel into Fiber</p>  	<p>HKRITA has developed a safe and dry closed system, which incorporates a sanitisation process to recycle old clothes to fibres mechanically. The recycled fibres generated are of good physical properties for re-producing various textiles products such as yarn, fabric and garments.</p> <p>The recycling process makes use of a high degree of automation through the use of Automated Guided Vehicle (AGV) and intelligent control of conveyors. Recycled colour-sorted fibres can be used directly for spinning without the need for dyeing and finishing. The efficient sanitisation of textile waste reduces at least 90% the micro-organisms in the waste according to the ISO 11737-1:2018 test method.</p> <p>This technology won a gold medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>
<p>3. Textile Waste Recycling by Biological Method</p>  	<p>HKRITA has developed a novel bioprocess which makes use of textile waste for the sustainable production of different value-added products, such as glucose, synthetic fibre, bioplastics, bio-chemicals and bio-surfactants.</p> <p>The process consists of pre-treatment, enzymatic hydrolysis and melt-spinning. The enzymes efficiently degrade the natural fibre (i.e. cotton) in the textile waste into glucose, leaving the highly pure polyester residues for the subsequent re-spinning process.</p> <p>This technology won a gold medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>

Project / Technology	Status / Progress
<p>4. Impact of Social Media on Colour Fashion Preferences</p> 	<p>This project has developed a colour prediction model by integrating sales, pricing and branding to meet operational needs such as product planning and inventory management. Through Natural Language Processing, the model makes use of fashion colour-related posts from fashion brands, magazines, designers and key opinion leaders in Facebook and Weibo, as well as products prices, market events and brand positioning, to predict future sales of fashion items of different colours. Advanced machine-learning methods are applied to improve the accuracy of fashion colour prediction.</p> <p>The model can be customised for different users based on their market positions and production lead time.</p> <p>This technology won a gold medal and a special prize from The National Research Council of Thailand at the 46th International Exhibition of Inventions of Geneva 2018.</p>
<p>5. Development of a Reusable and Comfort Facemask as a Barrier to Microorganisms</p> 	<p>HKRITA has developed a unique technique to embed magnetic field in facemask, which enables effective filtration without reducing permeability. Its ergonomic design provides improved thermal comfort and next-to-skin comfort of the facemask while preventing it from loosening. The facemask also provides an anti-microbial function which remains effective after washing for over ten times.</p> <p>This technology won a gold medal at the 46th International Exhibition of Inventions of Geneva 2018.</p>

Project / Technology	Status / Progress
<p>6. High Performance Sportswear and Devices (Wheelchair Cushion)</p>  <p><i>Photo provided by Hong Kong Paralympic Committee and Sports Association for the Physically Disabled</i></p>  	<p>HKRITA has developed high-performance wheelchair cushion for the boccia athletes of the Hong Kong Paralympic Committee & Sports Association for the Physically Disabled (HKPCSAPD).</p> <p>The high-performance wheelchair cushion has a multi-layer functional structure. The friction coefficient of its surface material ensures flexibility and stability upon movement. The cushion is made of 3D fabrics and special sponges in order to remove pressure and provide suitable support. Different materials are used for the ischial tuberosity areas of the cushion, allowing the user a smooth movement.</p> <p>The boccia athletes of HKPCSAPD are using the cushion in training and competitions, which are more comfortable and can better avoid injuries.</p>

**Automotive Parts and Accessory Systems R&D Centre (“APAS”)
Highlight of Operation in 2017-18**

I. New R&D Projects and Industry Contribution (in \$million)

	<u>2016-17</u>			<u>2017-18</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	1	4.5	n/a	3	9.1	1.2
Collaborative	3	18.1	8.2	3	48.0	24.3
Seed	8	19.2	n/a	2	5.1	n/a
Total:	12	41.8	8.2	8	62.2	25.5
Public Sector Trial Scheme	4	3.5	n/a	5	6.9	n/a

II. Operating Expenditure (in \$million)

	2016-17	2017-18
Staffing	11.6	9.7
Accommodation	2.3	2.7
Equipment	1.3	0.9
Others	2.5	3.1
Total:	17.7	16.4

III. Industry Income (in \$million)

	<u>2016-17</u>	<u>2017-18</u>
	Industry Income	Industry Income
Industry Contribution	8.2	25.5
Licensing/Royalty	*	-
Contract Services	1.5	0.7
Others	0.1	0.5
Total:	9.8 (9.7)	26.7 (26.7)
Project Cost	41.8 (18.1)	62.2 (57.1)
Level of Industry Income:	54%	47%

* amount under \$50,000

Note: Figures in brackets exclude projects not requiring sponsorship for the purpose of calculating the level of industry income.




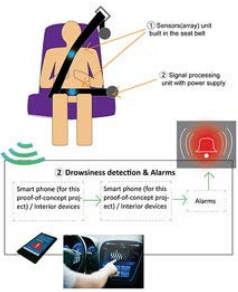
IV. Other Performance Indicators



	2016-17	2017-18
Number of Organisations Benefitting from the Public Sector Trial Scheme	15	16
Number of Interns Engaged	21	21
Number of Patents Filed	9(6)	5(5)

Note: Figures in brackets denote the number of patents granted.

V. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p>1. Electric Vehicle (EV) with Super-Capacitor Energy Storage System</p> 	<p>In collaboration with the Hong Kong Polytechnic University, APAS has developed a super-capacitor energy storage system in EVs. The system can instantly supply high power to EV's motor, absorb high feedback power and improve vehicle's system efficiency. The project has been completed and the team is working on the technology's commercialisation.</p> <p>This system won the Gold Award of the Hong Kong Innovative Invention Award 2017 organised by the Hong Kong Federation of Innovative Technologies and Manufacturing Industries in December 2017.</p>
<p>2. Plug-in Hybrid e-Coach</p> 	<p>APAS developed a 12m plug-in hybrid electric coach in 2017.</p> <p>The coach was designed and made in Hong Kong. In hybrid electric drive mode, the coach can operate continuously without stopping for recharge. This suits the busy fleet operation of commercial vehicles in Hong Kong. It can also offer more than 30% fuel saving and more than 50% emission reduction as compared to ordinary diesel coach.</p> <p>The plug-in hybrid e-coach can be switched to pure electric drive mode, under which zero emission is achieved and the range is up to 40 kilometres (km). The e-coach is equipped with a high quality, safer and fast-charging lithium titanate battery pack. With the plug-in charging feature, the vehicle can be charged to 80% in 24 minutes.</p>

Project / Technology	Status / Progress
<p>3. 16-Tonne Full-Electric Truck with Hook Lift for Solid Waste Collection</p>  	<p>APAS completed the development of a 16-tonne full-electric truck with hook lift for solid waste collection in 2017. The electric truck was designed locally in Hong Kong and manufactured in the Mainland. The truck is equipped with a high performance powertrain system, consisting of a permanent magnet synchronous motor and automatic gearbox, to run on hilly roads in Hong Kong.</p> <p>Besides, adopting a full electric design, it can offer zero emission compared to the ordinary diesel trucks. The lithium-ion battery pack installed in the truck is sufficient for over 200km per charge. By using an off-board fast charger, the vehicle can be charged to 70% in just 80 minutes.</p>
<p>4. Smart Safety Seat Belt</p>  	<p>Drowsy driving is a common cause of traffic accidents. To address the problem, the project team has developed a “Smart Safety Seat Belt” embedded with sensors to monitor the driver’s physiological signals and drowsiness level throughout the journey and transmit the information to smart devices such as smart phone or smart watch. If drowsiness is detected, alarms will be issued through the smart devices in the form of sound, voice, flash light or vibration to alert the driver until the driver is awakened to ensure safety.</p> <p>The project won a gold medal with Jury’s Commendation in the 46th International Exhibition of Inventions of Geneva 2018.</p>

Project / Technology	Status / Progress
<p>5. Multi-standard Mobilised Smart Charger for EV</p> 	<p>A 50kW combo charger prototype was installed at Hong Kong Automobile Association (HKAA)'s Yau Ma Tei depot in December 2017. A mobilised charger was delivered to HKAA in April 2018 and subsequently installed on a HKAA's van to provide emergency roadside charging service.</p> <p>HKAA and APAS jointly staged a media event in March 2018 to announce the Mobilised Charger Trial Scheme which provides the city's first emergency roadside EV charging service.</p>
<p>6. EV Portable Charger Kit (PCK)</p> 	<p>EV PCK separates the traditional EV charger into two parts – socket and charger. The cost to install and maintain a PCK socket is about one tenth of a traditional EV charger, making it affordable to install PCK sockets in car parks.</p> <p>EV PCK has obtained the CE marking on product safety and also received two industry recognitions, namely a Certificate of Merit for Equipment and Machinery Design at the 2017 Hong Kong Awards for Industries in December 2017 and a gold medal with Jury's Commendation at the 46th International Exhibition of Inventions of Geneva 2018.</p>