

# KNOWLEDGE TRANSFER

An abstract graphic featuring a large, thick red curved shape that resembles a stylized 'U' or a bowl. A thin yellow line starts from the left edge of the red shape and extends diagonally upwards towards the right. Along the inner curve of the red shape, there are several small yellow numbers: 12, 1, 2, 3, 4, 5, and 6, arranged in a sequence that follows the curve.

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The Hong Kong University of  
Science and Technology  
Clear Water Bay, Kowloon, Hong Kong

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## EXECUTIVE SUMMARY

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The Hong Kong University of Science and Technology (HKUST)'s Strategic Plan 2021-2028, announced in 2020, reinforced the key role that knowledge transfer (KT), and engagement with industry and the wider community play in the University's priorities and objectives for advancing to the next level of excellence. Over 2020-2021, the Strategic Plan objective to incorporate innovation and entrepreneurship into the HKUST spirit fostered novel KT initiatives that encompass the overall campus atmosphere and environment. A major way to drive forward the latter goal is through the University's Sustainable Smart Campus as a Living Lab (SSC) initiative. The cutting-edge endeavor, launched in 2019, is not only building a leadership role in sustainability but also helping transform the campus at Clear Water Bay. It is doing so by turning the campus into a testing ground for learning, experimenting, and advancing the innovative ideas and solutions of our faculty, students, staff and alumni to real-world issues. The novel concept of HKUST's SSC initiative will also be adopted in our new campus at the Hong Kong University of Science and Technology (Guangzhou) (HKUST(GZ)) to be opened in 2022.

Meanwhile, such an approach in combination with our joint research institutes and laboratories with prominent industry partners, and the synergizing efforts of the University's robust KT pipeline of funding schemes, technology and start-up incubation initiatives, intellectual property management and commercialization support, training of technopreneurial talents, industrial engagement and numerous other KT endeavors, had enabled HKUST to establish a strong research and innovation value chain based on the outcomes of the funded projects, which evidenced with unprecedented success in different areas of KT. Over the reporting year, the number of new license agreements tripled to 23 with 91 patents used, and the latter accounted for an increment of 3.6 times compared with the previous year. Owing to all these record-breaking achievements, the licensing income for 2020-2021 surged to HK\$11.9 million, an all-time-best result over the years. With the all-around support from various entrepreneurship programs to encourage technopreneurship, the number of new start-ups leveraging HKUST technology rocketed to 20, a 2.3 times increase compared to the preceding year.

As the following report of HKUST's KT-related activities and achievements in 2020-2021 shows, such outcomes are just some of the many significant steps forward during the past 12 months, as members of HKUST strive to identify and translate the University's technologies into innovation, start-ups, industry advances, and social impact.

## IMPACT CASES

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Despite the ongoing difficulties and restrictions arising from COVID-19 throughout 2020-2021, HKUST rose to the many challenges generated by the pandemic, resulting in a dynamic and productive year of development in its diverse knowledge transfer (KT) endeavors.

### PIONEERING A "LIVING LAB" CAMPUS

The Sustainable Smart Campus as a Living Lab (SSC) initiative is a major contributor to the fostering of a dynamic University-wide ambiance where creative ideas are not only discussed but also put into practice. Open to researchers, staff, and students, the endeavor has turned the HKUST campus itself into a platform for innovation and experimentation, supporting 26 novel projects from launch in 2019 to the end of June 2021. Significant projects include a "Sustainable Movable Vertical Garden" to create a self-sustaining, net-carbon-negative vertical farm involving off-grid energy generation and sequestration of carbon dioxide by plants grown hydroponically or aeroponically under weatherproof conditions; the "Digital Transformation of Laboratories with Smart Tracking Tray and Internet of Things (IoT) Technologies" to cut down on expired or mislabeled chemical and gases; and "Smart



*HKUST launches the "Sustainable Smart Campus as a Living Lab".*



Campus Air Network (SCAN)” to enable faculty to accurately identify air quality problems in populated indoor and outdoor campus locations and spur eco-friendly action.

Using the campus as a friendly and forgiving “Living Lab” has provided a nurturing environment to learn and grow from the experience of testing new ideas and approaches. It is also helping to demonstrate the University’s pioneering activities and technologies to industry and the wider community. Covering teaching and learning and cross-disciplinary collaborative education, the initiative to date has involved more than 150 faculty and some 400 students. SSC also works with the Bridge Gap Fund (BGF) to explore opportunities for engaging industry partners through technology commercialization.

A first step toward adoption of SSC innovations beyond the Clear Water Bay (CWB) campus is the transfer of viable projects to HKUST (GZ), maintaining linkage and creating synergy between the two locations. Key examples include the Digital Twin project and its extension Digital Twin+, initially involving the building of a digital replica of living and non-living physical assets and systems at the CWB campus. When coupled with real-time data, this has facilitated facility maintenance and management, and enabled simulations for greener campus planning and increased efficiency. The digital twin concept will be implemented at HKUST (GZ), currently under construction in Nansha.

In the reporting period, the HKUST 2050 Net-Zero Carbon Workshop Series was also launched. The key initiative will seek to develop large-scale research projects, leverage the SSC to test ideas, and draw up a roadmap for achieving net-zero carbon at both HKUST campuses.

In other sustainability advances, HKUST received movement permits from the Hong Kong government’s Transport Department in April 2021 to trial two autonomous vehicles at the CWB campus. Hercules is a low-speed (~30km/hour) logistics service vehicle, and the commercialized outcome of research and technologies developed by HKUST researchers led by Professor LIU Ming from the Department of Electronic and Computer Engineering and Department of Computer Science and Engineering, and Professor LIU’s award-winning start-up Shenzhen Unity-Drive Innovation Technology Co., Ltd. (UDI). During the COVID-19 lockdown in the Mainland, Hercules carried out unmanned deliveries in Zibo, a city in Shandong province, four times a day. In collaboration with UDI and industry, the University will pilot test additional autonomous vehicle technologies and gather field data, including a 500km run-in trial and deployment of Hercules to help with goods delivery at multiple points on campus. The collected data will be used by the Hong Kong government to facilitate the testing and certification framework of autonomous vehicles in the future.



*Shenzhen Unity-Drive Innovation Technology Co., Ltd. develops a series of autonomous vehicles to deliver supplies in the Mainland during the COVID-19 pandemic.*

### CREATING STRONG INNOVATION PIPELINE

Early identification of disruptive potential from University’s research outcome and strategic technology and business incubation are critical success factors in creating a strong innovation pipeline that attracts industry players and venture investors. From 2020, strategic management of the BGF enhanced this aspect of the pipeline, enabling high-potential research teams to carry out technology validation at the pre-commercialization stage, which in turn established a number of start-up companies and industry collaborations. BGF also works with the SSC initiative to maximize project outcomes. In 2020, the BGF received 34 applications. Eleven projects were selected, ranging from biomedicine and autonomous vehicles to IoT and communication. As of June 2021, four had been licensed or licensing was under discussion, two planned to launch start-up companies, and another two had generated approaches from key industrial partners for collaboration and potential commercialization.





Projects from the University's joint research units with leading industries and institutional partners (currently 21) also flourished over 2020-2021, further boosting the number of prospective HKUST KT endeavors being explored. Along with funding, such centers facilitate and strengthen researchers' industry engagement, building understanding of business needs and parameters in adopting and scaling up new technologies. By June 2021, HKUST-Bright Dream Robotics Joint Research Institute (HBJRI), approved 14 main projects (HK\$38 million). HKUST-Kaisa Joint Research Institute (HKJRI), supported 24 main and seed projects (HK\$50 million), covering materials, IoT, fintech, healthcare, and autonomous vehicles. Meanwhile, the HKUST Collaborative Innovation Center (HCIC), a joint endeavor with major universities in Beijing, called for applications for its HKUST Innovation Leaders Program, starting in September 2021. The pilot program is set to enrich the entrepreneurial experience of University postgraduates involved in optoelectronics, biomedical engineering, and materials and environment.



*The HKUST-Bright Dream Robotics Joint Research Institute, HKUST-Kaisa Joint Research Institute and HKUST Collaborative Innovation Center are established to enhance industrial collaboration.*

PhoMedics Ltd., a 2020 BGF recipient and HKJRI-supported firm, exemplifies the impact of HKUST's effective early-stage strategies to spur practical innovation. PhoMedics, a medical technology start-up founded by Professor Terence WONG from the Department of Chemical and Biological Engineering (CBE) and his research team, is focused on next-generation cancer treatment with its patented computational high-throughput autofluorescence microscopy with pattern illumination (CHAMP) technology, providing surgeons with instant detection and accurate feedback on the clean eradication of cancer cells during surgery. PhoMedics has gone on to receive multiple awards, and become a Technology Start-up Support Scheme for Universities (TSSSU) awardee in 2021. It has also been admitted to the Hong Kong Science and Technology Parks Corporation's Science and Technology Entrepreneur (STEP) and Incu-Bio programs.

#### FLAGSHIP ONE-MILLION-DOLLAR ENTREPRENEURSHIP COMPETITION CELEBRATES 10TH ANNIVERSARY

On the entrepreneurial talent development front, the University's flagship One-Million-Dollar Entrepreneurship Competition celebrated its 10th anniversary in 2020. Originally launched at the CWB campus, the contest provides an integrated learning experience to advance the creation of new businesses and build entrepreneurship skills, including business plan presentations and pitching. The enterprising concept has since enabled the competition's expansion to eight regions nationwide and a Grand Final.



*Ten HKUST start-ups are recognized as "Unicorns of Tomorrow" in the Grand Final of the One-Million-Dollar Entrepreneurship Competition.*

The 2020 event attracted a record high 1,826 entries from Hong Kong (151), Macao (38), Beijing (321), Guangzhou (566), Shenzhen (193), Foshan (145), Zhongshan (235), and the Yangtze River Delta (177), with Shenzhen Sitan Technology Co., Ltd., founded by HKUST alumnus Dr. LIU Zhaojun and regional champion of Foshan, winning the Grand Final in Guangzhou. The company focuses on cutting-edge micro-LED technology and display, and since winning has completed a pre-A round of financing.

The Grand Final drew hundreds of on-site spectators, despite COVID-19, along with 1.7 million viewers who watched the live online broadcast. In a special anniversary feature, 10 start-ups founded by the HKUST community and valued between RMB1 billion and RMB10 billion also received recognition. Among these alumni "Unicorns of Tomorrow" was Zhuhai Yunzhou Intelligence Technology Ltd. (Yunzhou), emerged from the 1st One-Million-Dollar Entrepreneurship Competition, China's first unmanned surface vehicle company. Yunzhou focuses on the provision of unmanned boats for diverse service areas, including water environmental protection, ocean surveys, and water rescues. The company's products have assisted in different scenarios nationally,



including the Tianjin Port explosions and water pollution in Xixia County in Henan, with its business reach now extending to more than 30 counties and regions worldwide.

The Hong Kong regional event, held online for the first time due to COVID-19, drew 29% more participating teams than the previous year, and the highest in a decade.

The success of SPES Tech Ltd. as the winner of the One-Million-Dollar Entrepreneurship Competition in the Hong Kong region (President Award and GF Innovation Award) also demonstrates HKUST's comprehensive support for its aspiring entrepreneurial talents. The biotechnology start-up, inspired by the research of Professor SUN Fei, CBE, and founded by his former students, has developed LitGel, a proprietary photosensitive smart hydrogel resembling human tissues. This enables LitGel to be used to deliver live cells into humans, assisting biomedical research studies while minimizing allergies and rejection by the body. KT support for SPES Tech's journey to recognition has included the provision of laboratories and state-of-the-art equipment for product testing, advice on intellectual property protection, US patent registration, and admission to multiple HKUST funding schemes, including the BGF (then Proof-of-Concept Fund), Yeung Wing Yee Entrepreneurs Fund, and HKUST Entrepreneurship Fund, among others.



(From right) Mr. WONG Ka Chin from SPES Tech, Professor Gary CHAN, and Professor Terence WONG and his PhD student ZHANG Yan from PhoMedics.

### CYCLING INTO A HIGH-ACHIEVING FUTURE THROUGH COMMUNITY PARTNERSHIPS

In addition to technology transfer to industry and the business sector, the University strives to partner with community organizations to enable its innovative research to deliver direct social impact in Hong Kong and beyond. The two-year A. Kwok Sports Aerodynamics Science Initiative, launched in 2019, is among such projects. The initiative has propelled forward an enterprising co-operative endeavor between HKUST engineering researchers, led by Professor ZHANG Xin from the Department of Mechanical and Aerospace Engineering, and the Hong Kong Sports Institute, the city's premier sports training institute for elite athletes. It has also engaged support from the government's Innovation and Technology Fund, and a private donation from Sun Hung Kai Properties Executive Director Mr. Adam KWOK Kai-Fai.



HKUST and Hong Kong Sports Institute join hands to enhance performance of Hong Kong's international renowned cycling team ahead of Tokyo Olympics.

The leading-edge technology transfer venture set out to enhance the performance of Hong Kong's internationally renowned cycling team ahead of the Tokyo Olympics, including participation by top star LEE Wai-Sze. It has involved combining an advanced aerodynamic rig with computational fluid dynamics based on Formula One racing car technology to hone the cyclists' performance through their posture and clothing, among other enhancements. Ms. LEE noted it had been exciting to be part of the initiative, which included wind tunnel tests and helped boost the team's potential to succeed. She won a bronze medal in the Women's Sprint event (Track Cycling) of the Tokyo 2020 Olympic Games for Hong Kong and a gold medal in the inaugural 2021 UCI

Track Cycling Nations Cup at the Hong Kong Velodrome.

The HKUST researchers are now seeking to extend the relationship with the sports science team at the Hong Kong Sports Institute and expand the technology to other sports.



## NURTURING TECHNOPRENEURSHIP: STRENGTHENING ENTREPRENEURIAL CAPABILITIES AND START-UP INCUBATION/ACCELERATION

To promote the technopreneurial spirit at HKUST, partnerships teaming faculty research outcomes and student entrepreneurship are strongly encouraged to drive the application of discoveries and spur the establishment of start-ups built on HKUST technologies. By licensing HKUST technologies to promising start-ups, the University transforms its research output into products and services with societal impact. Together with HKUST's other entrepreneurial efforts, including entrepreneurship training and education programs, mentoring, and incubation programs, the University is thus able to nurture a campus-wide culture of innovation and entrepreneurship. In 2020-2021, HKUST active start-ups and spin-offs reached 290. Among them, 19% leveraged HKUST technologies.

### EXPANDING THE ENTREPRENEURIAL PIPELINE

The Entrepreneurship Center (EC) incubated 46 start-up companies in 2020-2021, spurred by a wide range of entrepreneurship events and EC staff's guidance and support. The TECHnopreneurSHIP (Tech-Ship) Program, jointly organized by the Technology Transfer Center (TTC) and EC, matched 50 students with 23 faculty members for partnerships to commercialize HKUST intellectual property (IP). Over 1,700 students realized their ideas in competitions including hackUST 2021, the HKUST-Sino One-Million-Dollar Entrepreneurship Competition 2021, and HKUST-Kaisa Autonomous RC-Car Competition, among others. Seventy-four start-up projects and businesses



HKUST Dream Builder Funds provide support for various entrepreneurship activities.

received funding support totaling over HK\$1.2 million. Meanwhile, the BASE continued to provide space for start-ups to work on and introduce projects to the HKUST community, partners, and investors, with many of the endeavors focused on sustainability. Such activities help enrich the entrepreneurial spirit on campus as well as boost understanding of how technology and entrepreneurship can tackle real-world challenges and social problems. In addition, EC often seeks to connect University member-founded start-ups with industry and potential business partners and key incubators, such as Hong Kong Science and Technology Parks Corporation (HKSTP) and Hong Kong Cyberport Management Company Ltd. (Cyberport). During 2020-2021, over 20 start-ups were nominated by the EC and fast-tracked into incubation programs at HKSTP and Cyberport.

### BRIDGE GAP FUND

In 2021, further support to encourage younger faculty to translate research outcomes into viable IP was introduced to the Bridge Gap Fund (BGF) with the launch of the Seed Project Support Scheme. The BGF funded a total of 14 projects in the area of biotechnology, materials, electronics, internet of things and robotics.

### TECHNOLOGY START-UP SUPPORT SCHEME FOR UNIVERSITIES

The Innovation and Technology Commission launched the Technology Start-up Support Scheme for Universities (TSSSU) in 2014, and it enabled the University to further support for technology-focused start-ups. In 2020, 64% of the businesses formed by the 14 HKUST TSSSU 2020 funding awardees were based on University technologies. With the support of the TSSSU funding, these teams can further commercialize the HKUST technologies in order to benefit the society. Around 92% TSSSU 2020 funding awardees had participated in HKSTP- and Cyberport-organized incubation programs, which was increased for more than 20% comparing with the previous round of TSSSU. Furthermore, the awardees also had remarkable business development progress with around 86% of the awardees received external funds and created around 50 jobs and training opportunities in the year under review. In addition, the TSSSU 2021 attracted record-high 54 applications, bringing the total number of the University's TSSSU funding applications in the last eight years to 324. In the TSSSU 2021, 19 start-ups were recommended to the Innovation and Technology Commission (ITC) by the HKUST vetting committee, increasing the total number of HKUST affiliated TSSSU start-ups to 78.





## HKUST ENTREPRENEURSHIP FUND

The HKUST Entrepreneurship Fund (E-Fund) actively linked up with more than 100 HKUST start-ups and assessed them for investment opportunities. The E-Fund team of TTC works closely with the EC to improve the quality, financial sustainability, and attractiveness of HKUST start-ups by providing practical training and mentors to HKUST start-up communities, and join forces with TTC's Technology Clusters to coach for start-up teams being incubated by the BGF. The E-Fund further supports HKUST start-ups and companies admitted to the HKSTP and Cyberport programs by helping to establish connections with co-investment partners and advisors to assess potential investments and provide advice. There are currently 13 Co-Investment Partners under the E-Fund's Co-Investment Model, managing an investment pool of more than HK\$7 billion and investing approximately HK\$25 million in E-Fund portfolio companies. An advisory panel comprising 14 international experts advises on due diligence for investment under the HKUST-Initiated Investment Model.

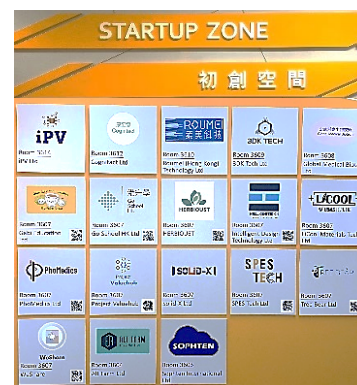


*The HKUST Entrepreneurship Fund aims to provide support to promising early-stage HKUST technology start-ups.*

Since December 2019, the Investment Sub-Committee, under the University Council's Knowledge Transfer Committee, has approved nine investment proposals totaling HK\$9.4 million. Co-Investment Partners, along with other investors, have invested seven times higher amounts than the E-Fund, demonstrating the fund's role as a catalyst to attract quality investors who not only recognize the strong potential of many HKUST start-ups but are also prepared to provide significant financial support.

## HKUST ENTREPRENEURSHIP PROGRAM

The HKUST Entrepreneurship Program (EP) has supported a total of 66 technology start-ups at the Clear Water Bay (CWB) campus since the Program's launch in 1999. Four are currently being incubated, among the other incubatees in the HKUST Start-up Zone, while 62 have graduated from the Program. The recent renovation of the physical incubation space at the CWB campus has now enabled a higher occupancy level in the HKUST Start-up Zone in the past five years. In addition to attracting and cultivating potential incubatees, a revamp of the Program on the talent development front is also planned, to provide more practical support related to human resources, finance/accounting, legal advice, and mentorship to start-ups.



*HKUST Start-up Zone and its Incubatees.*

## TECHNOPRENEURSHIP START-UP HIGHLIGHT: INFITECH LTD.



*Professor Nancy IP describes Alzheimer's as an "invisible pandemic" in aging society.*

Dr. Fanny IP Chui-Fun, Professor Amy FU Kit-Yu, both Division of Life Science and Professor Nancy IP Yuk-Yu, Vice-President for Research and Development, have been researching Alzheimer's disease-related conditions and neurodegeneration since 1993. This has included the incorporation of Chinese medicine into the predominantly Western-based therapeutic field to strengthen the brain and synaptic functions before these areas and their capabilities deteriorate. In 2018, the trio co-founded INFitech, a biotechnology start-up, to translate their 20-years of research into health supplements, which are now available in the market. INFitech was awarded seed funding under the

Technology Start-up Support Scheme for Universities (TSSSU) for 2018-2019 and 2019-2020, and is also a member of the HKUST Entrepreneurship Program.





## STRENGTHENING INFRASTRUCTURE, CAPABILITIES AND PARTNERSHIPS

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With over 81% of research outputs, impact cases and research environment statements being rated as “internationally excellent” or “world-leading”, and nearly 90% of our research impact cases were assessed to have “considerable or outstanding impacts” in terms of reach and significance in the Research Assessment Exercise 2020 (RAE 2020) of the University Grants Committee (UGC), HKUST has demonstrated its dedication to the all-time mission of enriching and expanding its innovation and entrepreneurship culture to benefit society at large, with the strategic objective of becoming a powerhouse for innovation and entrepreneurship despite the shadow of the COVID-19 pandemic.

### FOSTERING RESEARCH EXCELLENCE

Despite the challenges of 2020-2021, HKUST received a total of HK\$618.4 million for 144 collaborative research projects to be jointly conducted with local, Mainland China, and overseas partners. With 64 research laboratories, centers, and institutes on the Clear Water Bay (CWB) campus, as well as three HKUST research centers under the Hong Kong government’s InnoHK initiative, HKUST is provisioned and committed to proactively seeking synergy and collaborations to foster interdisciplinary research, knowledge sharing, the nurturing of next-generation talent, and social impact. These research endeavors will be broadened and deepened in subsequent years with the opening of HKUST(GZ), the University’s new campus in Guangzhou.

#### Theme-based Research Scheme Projects

Professor CHEN Kai, Department of Computer Science and Engineering (CSE), received funding of HK\$33.3 million under the prestigious Research Grants Council Theme-based Research Scheme in 2020 to work with the government and industry partners to develop a high-performance distributed machine learning framework for smart city applications, driven by an artificial intelligence (AI) computing cloud platform. The framework seeks to efficiently handle and make accurate predictions from graph-based streaming data to support applications for areas including transportation optimization (for example, identification of bottlenecks in traffic and deployment of AI-enhanced taxi dispatching platform), urban planning, and crowdsensing. The hub should also help researchers and practitioners engage in data collaboration beyond Hong Kong through inter-city knowledge sharing.

#### Research Impact Fund Projects

The year under review saw two Research Impact Fund projects awarded to HKUST faculty. Professor ZHAO Tianshou, Department of Mechanical and Aerospace Engineering, received HK\$6.58 million to develop safe and energy-dense all-solid-stage lithium batteries, while Professor LI Bo, CSE, was awarded HK\$5.72 million to advance secure and efficient machine learning via pooled data from across organization domains.

#### Applied Research Projects

The University continued to work closely with industry to transfer knowledge into novel applications, assisted by funding support from the Innovation and Technology Commission (ITC), which provided HK\$108.7 million for 31 HKUST applied projects that commenced in 2020-2021. Among these projects, Professor Gary CHAN, CSE, received HK\$8.1 million to develop a suite of novel internet of things and multimodal analytic technologies that can recognize objects, sense people, and perform user analytics for smart car parks. ITC’s Midstream Research Program funded four HKUST projects, including HK\$7.7 million to support a project by Professor Nancy IP, Vice-President for Research and Development, to develop a blood-based biomarker platform for accurate diagnosis of Alzheimer’s disease. Her collaborators included Haven of Hope Christian Service and Queen Mary Hospital.



## Projects Funded by Mainland Sponsors

Mainland sponsors provided another major source of research funding. Among such sponsors, the University received HK\$16.6 million from the Ministry of Science and Technology, and a total of HK\$18.8 million for four projects from Zhongshan Municipal Bureau of Science and Technology. Professor LIU Ming, Department of Electronic and Computer Engineering and CSE, received HK\$5.55 million for his autonomous vehicle project related to a “driverless security monitoring system”.

## DONATIONS FROM INDUSTRY

Over the year under review, HKUST received a number of generous donations from the community. These included a HK\$100 million donation from Chow Tai Fook Charity Foundation Ltd. to enhance research capabilities in various areas. Mr. Andy FEI Chi-En donated HK\$20 million to set up the “Fei Chi En Education and Research Fund”, to support HKUST’s innovation and technology research projects and related facilities, with HK\$2 million used to establish the “Y-Lot Foundation Scholarship” for students to turn their innovation and technology ideas into projects or prototypes for competitions. The Yuexiu Group donated HK\$80 million towards the development of teaching, research, and innovation under the “Unified HKUST, Complementary Campuses” framework being adopted by HKUST’s CWB and future Guangzhou campus, which will enable the two campuses to complement each other without duplicating academic programs.



*In 2020-2021, HKUST receives significant donations from prominent industrial leaders.*

## TECHNOLOGY TRANSFER ENDEAVORS

### INVENTIONS, PATENTS, INTELLECTUAL PROPERTY, CONTRACTS, AND SERVICES

HKUST has developed a comprehensive and robust intellectual property (IP) portfolio, which is set to work with various engagement models through HKUST R and D Corporation (RDC), the University’s business arm. RDC partners with the private sector in a wide range of technology areas, with total income from contract research, consultancy, and testing services, including projects initiated by HKUST’s Mainland platforms, reaching HK\$120.6 million in 2020-2021.

### LICENSING AND RELATED ACTIVITIES

The University also proactively explores opportunities for IP licensing to the commercial sector, with an income of HK\$11.9 million generated from licensing by RDC, Massive Open Online Courses and the University’s Mainland platforms in the year under review. This represents an increase of 21% compared with the previous year.

Significant figures of knowledge transfer regarding inventions, patents, licenses, IP, contracts, and services are listed below.

Invention Disclosures	New Patent Applications Filed & Granted	Cumulative Active Pending Patent Applications and Granted Patents	No. of Active Licensing Agreements
176	332 / 205	1,759	120
IP Income Generated (Cash Received)	Contract Research & Income Generated (Cash Received)	Consultancy Projects & Income Generated (including Analytical & Testing Services) (Cash Received)	
HK\$11.9 million	221 / HK\$111.5 million	385 / HK\$9.9 million	

A new IP management team was set up to strategically identify inventions with strong commercialization potential and establish strategic IP portfolio management to enhance innovation outcomes. Reengineering the existing process significantly enhanced the speed of patent applications, with provisional patent applications now



able to be filed in seven working days to protect HKUST inventions without delay in journal publications. Confidentiality management and patent sunseting have also been implemented to enhance the management of collaborator's confidential information and streamline the patent portfolio.

The strengthened industrial engagement effort enabled the Cluster Technology Business Development team to a record-high number of new license agreements and patents used, recording 3.6 times of patents used higher than the previous year.

### IP KNOWLEDGE DISSEMINATION

The Technology Transfer Center and Entrepreneurship Center co-organized seminars in partnership with prominent IP practitioners and renowned IP firms, "How to Make a Better Invention Disclosure", "What HKUST Researchers Need to Know about Patents", and "IP Strategy for Technology Start-up" to equip researchers and technopreneurs in the University community with essential IP knowledge and skills. The seminars attracted over 200 attendees, including HKUST members, established IP practitioners, and leading entrepreneurs.

## CULTIVATING AN INNOVATION AND ENTREPRENEURIAL SPIRIT

Entrepreneurship is an integral component of knowledge transfer at HKUST, with the University providing numerous platforms to support innovative endeavors by faculty, students, and alumni to foster their entrepreneurial spirit.

### MENTORHUB@HKUST

Unlike traditional mentoring that emphasizes face-to-face interactions between pre-assigned mentors and mentees, mentorHUB@HKUST offers a more dynamic mentorship model and experience by allowing mentors and mentees to reach out to one another anytime and anywhere, enabling real-time feedback and just-in-time outcomes to facilitate start-ups' early-stage growth. In 2020-2021, mentorHUB attracted 37 established mentors and 207 mentees from 88 start-up teams across 11 fields and industries.



MentorHUB@HKUST

### ONE-MILLION-DOLLAR ENTREPRENEURSHIP COMPETITION 2021



*HKUST One Million Dollar Entrepreneurship Competition is expanded to national-wide eight regions to provide a platform for HKUST and surrounding community members an integrative learning experience.*

The competition serves as a valuable integrative learning experience in the creation and evaluation of new businesses as well as helping equip students for an entrepreneurial career. It was first launched by HKUST in 2011 and by 2021, covered eight regional contests nationwide and a Grand Final. As an indication of the contest's appeal, the 2021 Hong Kong regional contest attracted over 700 participants from 185 teams, largely comprising HKUST faculty, staff, students, and alumni hailing from nine countries and regions. This year the Shenzhen regional competition newly introduced three channels comprising Shenzhen-Hong Kong Channel, Industry Channel, New Finance Channel to better cater to participants'

different areas of interest. The Shenzhen regional competition received title sponsorship from China Construction Bank Shenzhen Branch for the New Finance Channel, while Tian An Cyber Park sponsored the Industry Channel.



## TECHNOPRENEURSHIP PROGRAM (TECH-SHIP)

Organized by the HKUST Entrepreneurship Center (EC) and Technology Transfer Center (TTC), in collaboration with HKUST's four schools, the Tech-Ship Program brings faculty technology together with student entrepreneurial aspirations to foster entrepreneurship development. In 2020-21, 50 students from different Schools and backgrounds were matched with 23 faculty members to begin the journey of commercializing HKUST intellectual property.



*The TECHnopreneurSHIP PITCH - Technology X Business Idea Contest is a platform to design business ideas with university technologies.*

## HACKUST

2020-2021 proved a remarkable year for hackUST, attracting over 860 student participants, a record-breaking for the event. First launched in 2014, hackUST and hardUST have gone on to become the most significant hackathons held in Hong Kong, not only building students' innovation and entrepreneurial spirit but also drawing the attention of organizations looking for recruits and creative solutions to adopt in their operations.

## HONG KONG TECHATHON 2021

Co-organized by Hong Kong Science and Technology Parks Corporation, HKUST, and six other local universities, Techathon provided a week-long platform for programmers, engineers, designers, marketers, and entrepreneurs to collaborate and develop ideas and prototypes, and to pitch for seed funding and incubation support. HKUST members demonstrated their strong entrepreneurial capabilities, constituting 35% of the 937 participants. In addition, six of the 12 winning teams comprised HKUST members.

## HKUST-KAISA AUTONOMOUS RC-CAR RACING COMPETITION

This contest translated the interest of technology enthusiasts campus-wide into applications for autonomous radio-controlled vehicles, attracting 94 HKUST participants from technical and non-technical backgrounds. Those joining the competition formed 25 teams and participated in four training workshops from November 2020 to January 2021 before showcasing the possibilities of their technological innovations to the HKUST community. The Chairman of the Kaisa Group and HKUST President Professor Wei SHYY attended the final in April 2021.



*Winners of the HKUST-Kaisa Autonomous RC-Car Racing Competition share their moment of glory.*



*The Inside Venture Capital: VC Workshop attracts over 140 participants.*

## INSIDE VENTURE CAPITAL: VC WORKSHOP

The TTC and EC co-organized the Inside Venture Capital: VC Workshop, delivered by Mr. Douglas ABRAMS, Founder and CEO of Expara Pte. Ltd., providing four 1.5-hour live webinars and companion online course materials. The workshop explored how entrepreneurs develop business plans that optimize the product-market fit, build models demonstrating financial potential, and negotiate good investment deals. The workshop drew over 140 participants, including current students, alumni, and faculty.

## REINFORCING INDUSTRIAL ENGAGEMENT AND COLLABORATION

### COLLABORATION WITH LEADING INDUSTRIAL PARTNERS AND ORGANIZATIONS

Through HKUST R and D Corporation, the University partnered 49 local and global companies, as well as nine Hong Kong government departments, to carry out downstream technology development and services in 2020-2021. The University also conducted international collaborative projects with companies in the US, South Korea, and Japan. In the year under review, new project contracts worth HK\$103.1 million were signed. This number demonstrated strong growth with a compound annual growth rate (CAGR) of 12% over the past six years. Among





the contracts signed, 35 projects had a contract value of more than HK\$1 million. Selected projects are highlighted below:

#### **Low-Frequency Noise Reduction in Nacelle**

A Mainland aviation company set out to utilize the HKUST specific broadband sound absorber as the background technology for testing measurement to generate data to facilitate low-frequency noise reduction in the nacelle, the casing housing an engine in airplanes, or the generating components in wind turbines.

#### **Compact Low-Frequency Wave Absorption**

A collaboration with a Japanese giant in the automotive industry is set to leverage breakthrough technology developed by Professor SHENG Ping, Department of Physics, and focused on thin acoustic absorption materials covering the low-frequency range to deliver effective and compact low-frequency absorption materials with wide applications in automobiles.

#### **Next-Generation Wireless Communication Systems**

Sixteen R&D contracts totaling tens of million dollars were signed in 2020-2021 with one of the leading global providers of networking and telecommunications technology and equipment. The contracts covered wireless communication and networking, artificial intelligence and data science, algorithm design, IC design, and system architecture, among others, and are expected to contribute to the development of next-generation wireless communication systems.

#### **Wastewater Treatment Technology**

In a series of cost-effective collaborations with the Drainage Services Department, Professor YEUNG King-Lun, Department of Chemical and Biological Engineering and Division of Environment and Sustainability, and his research team have developed three novel eco-friendly technologies with high impact for the community and wastewater treatment service providers. The researchers have successfully conducted large-scale field tests for their novel controlled-release hydrogel, eliminating the malodor that emanates from drainage and sewerage systems causing nuisance to neighbor communities. The hydrogel suppresses higher than 97% of the foul-smelling hydrogen sulphide generated by microbial activities in nullahs, box culverts, sewers, and related infrastructure through a continuous release of biocides and inhibitors specifically targeting the microorganisms causing the malodor and designed to last at least 30 days. Professor YEUNG's team is also developing LiquidGel (LG), a technology for odor control of dewatered sludge, as well as an anti-biofilm epoxy coating to control corrosion resulting from biogenic acid produced by microorganisms and reduce maintenance and replacement costs for sewerage pipe networks.

#### **HKUST SIGNS COOPERATIVE AGREEMENT WITH GUANGZHOU METRO TO NURTURE TALENTS IN INTELLIGENT TRANSPORTATION**

HKUST and Guangzhou Metro Group Co., Ltd. (Guangzhou Metro) signed an agreement to jointly nurture postgraduate talents in intelligent transportation, an innovative field combining transportation, artificial intelligence and data science, and one of the key thrust areas of the HKUST(GZ) campus. The MPhil and PhD degree programs will be available in 2021-2022 under HKUST(GZ) pilot scheme. Students will be jointly supervised by HKUST professors and professor-grade senior engineers, or equivalent, appointed by Guangzhou Metro. Students will also be provided with internship and research opportunities sponsored by Guangzhou Metro. The program is an example of cross-disciplinary collaboration



*Guangzhou Metro will open its "National Engineering Laboratory for the System Safety and Operation Assurance of Urban Rail Transit" to students participated in the joint program.*



between academia and leading enterprises to build know-how and urban transport technologies in the Greater Bay Area (GBA).

### HKUST AND TENCENT FINANCE ACADEMY (HONG KONG) FOSTER FINTECH SKILLS

HKUST and Tencent Finance Academy (Hong Kong) signed a Memorandum of Understanding, which seeks to establish a strategic partnership to extend the pool of fintech professionals by nurturing skills and collaborating on education and research and development projects. The two institutions will together develop a fintech curriculum. Other initiatives include internship opportunities for HKUST students, joint fintech-related research and development projects, and education outreach programs to improve public awareness of fintech. The series of programs aim to support and enhance the development of fintech and encourage young talents to take up the opportunities brought about by the GBA development.



*HKUST and the Tencent Finance Academy (Hong Kong) representatives sign a Memorandum of Understanding on nurturing fintech talent.*

### ENHANCING COMMUNITY ENGAGEMENT

HKUST's knowledge transfer endeavors include organizing events for industry practitioners, the private sector and the public. In 2020-2021, the University organized 564 public lectures, workshops, seminars, and public engagement activities, along with 33 performances and exhibitions of creative works. Well experienced in organizing virtual and hybrid activities, the events attracted over 8.4 million attendees, an 85% increase compared with the previous year, and an indication of the University's reach. In addition, HKUST members strive to deliver innovative products and solutions to tackle challenges facing the community. Highlights of the University's community activities in 2020-2021 included.

#### 2021 HANG LUNG MATHEMATICS AWARDS



*Hang Lung Properties and HKUST co-organize the biennial Hang Lung Mathematics Awards (HLMA) to nurture talented young mathematics and science students in Hong Kong.*

In January 2021, HKUST and Hang Lung Properties announced they would jointly organize the biennial Hang Lung Mathematics Awards (HLMA), an initiative that promotes mathematics and science education among secondary students and identifies young mathematicians with high potential. Students take part in teams comprising up to five members, under the supervision of a teacher. Participants have to identify a mathematics research topic, conduct independent research, and submit a report by the end of August 2021. Shortlisted teams will then be invited to an oral defense in December, after which winners will be selected. Under the partnership, Hang Lung Properties will donate HK\$2.5 million to each competition, with HK\$1 million of this used

as prize money. Professor Richard SCHOEN, 2017 Wolf Prize Laureate in Mathematics, is Chair of the 2021 HLMA Scientific Committee, with Professor George SMOOT, 2006 Nobel Laureate in Physics, and Chair Professor of Physics at HKUST, serving as Chair for the 2021 HLMA Steering Committee.

### HKUST DEVELOPS MORE EFFICIENT DISINFECTION METHOD WITH ULTRAVIOLET LIGHT-EMITTING DIODE

To assist the community in the fight against COVID-19 and other infection issues, University researchers led by Professor Ricky LEE, Department of Mechanical and Aerospace Engineering and Director of the Electronic Packaging Laboratory at HKUST, developed a closet that can kill 99.99% of bacteria and viruses on the garments inside within a minute. The HKUST research team's solution, funded by the Innovation and Technology Commission under the Public Sector Trial Scheme for Coronavirus Disease



*HKUST researchers develop a closet that can kill 99.99% of the bacteria and viruses on the garment inside within a minute.*



2019, enhances the efficiency of the ultraviolet (UVC) light-emitting diode (LED) technique, doubling the UVC output from 50% to over 90% and extending the sterilization distance. Prototypes of the closets are now being trialed at three schools under Po Leung Kuk.



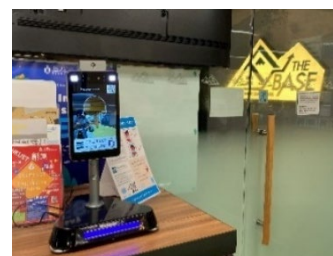
*Planeteers, a HKUST start-up, creates a vegan and biodegradable edible cutlery to fight the city's mounting waste and pollution crisis.*

### EAT YOUR SPOONS AND FORKS TO BEAT PLASTIC POLLUTION

In response to the surge in plastic waste generated in Hong Kong and elsewhere, amid COVID-19, two School of Business and Management undergraduate students Aditi DEODHAR and Swapnil MISHRA, have invented vegan and biodegradable edible cutlery made from whole-grain flours as an alternative to single-use plastic ones. The students started to realize their idea for the cutlery and their company, Planeteers, when they took part in the 2020 HKUST-Sino One-Million-Dollar Entrepreneurship Competition, receiving an award in the Environment and Sustainability category. Aditi and Swapnil started by experimenting with their products in a student dorm kitchen, going on to receive assistance from the Entrepreneurship Center, which linked them to the Campus Services Office that offered the use of a well-equipped kitchen. The team is continuing with product development and working toward wide acceptance of their edible cutlery.

### LOW-COST THERMAL CAMERA-BASED BODY TEMPERATURE SELF-CHECKING STATION

A cost-effective body temperature self-checking station with embedded machine learning tools developed by a student start-up team, "Thermal Plus", was brought to market to meet the demand for cost-effective non-contact checking devices. The team was led by Mr. FUNG Kwong-Chiu, MPhil in Technology Leadership and Entrepreneurship, and advised by Professor MOW Wai-Ho, Department of Electronic and Computer Engineering. A cloud-based software platform was also built to facilitate cross-station management and allow real-time analytics of privacy-preserving usage data. The invention led the team to form "Intelligent Design Technology Ltd.", which has successfully raised HK\$100,000 seeds funding, and has been widely used by over 30 local organizations, including schools, churches, and non-government organizations (NGO).



*A cloud-based temperature sensing system installs in the BASE, HKUST.*

### SMART INFRASTRUCTURE CONFERENCE



*The Smart Infrastructure Conference attracts over 600 participants.*

The Smart Infrastructure Conference was held at HKUST in May 2021, attracting over 600 participants, who attended either in-person or online. Co-organized by the Department of Civil and Environmental Engineering, Civil and Environmental Engineering Alumni Association, HKUST GREAT Smart Cities Institute, Smart City Consortium, and the Hong Kong Institution of Engineers, the Conference featured industry-leading keynote speakers, who shared ideas on smarter infrastructure solutions to address challenges while maintaining sustainability in densely populated areas such as Hong Kong.

### REAL-TIME DETECTION OF MICROPLASTICS USING SMART FISH

Marine sustainability received a boost after a team of final-year undergraduate science and engineering students designed and created a vessel that can quantify microplastics on the surface of seawater in real-time. Team members, supervised by Professor Frank LAM, Department of Chemical and Biological Engineering and Dr. Cindy LAM, Department of Ocean Science, integrated practical staining methodology and an image-capturing system to come up with



*Smart Fish in operation, analyzing microplastics on the sea surface.*



their cost-effective “Smart Fish” prototype. The student team received the Hong Kong Institution of Engineers (HKIE) Environmental Division Prize for Best Final Year Environmental Project in 2020 for the craft.

#### HKUST BUSINESS SCHOOL ORGANIZES HONG KONG’S FIRST BLOCKCHAIN-THEMED CASE COMPETITION



The School of Business and Management, together with HashKey Digital Group, organized the Blockchain Business Model Challenge, a case competition for local universities, to promote blockchain to the public and diversity in the Hong Kong fintech and blockchain community. Eighty students and university graduates formed 20 cross-disciplinary teams participating in the event. The contest was supported by Wanxiang Blockchain Labs, Cyberport Hong Kong, the University of Hong Kong, and InvestHK.

*The first blockchain-themed case competition is successfully organized in Hong Kong.*

### ACTIVE MAINLAND ENGAGEMENT

#### HKUST (GUANGZHOU) CAMPUS MOVES FORWARD

Provost Professor Lionel NI was appointed Founding President of HKUST(GZ) in 2020-2021. The University’s new campus in Nansha creates an exceptional opportunity for HKUST to develop to the next level of excellence physically and conceptually with knowledge transfer focus, together with education and research. In line with the Unified System, Complementary Campuses Framework being adopted by the Clear Water Bay (CWB) and HKUST(GZ), the two campuses are set to advance in synergy, with both being treated as “living labs”, for members to try out and showcase their novel solutions and technologies, and priority given to projects addressing the “grand challenges”, such as sustainability.



*Impression of the HKUST(GZ) campus.  
Photo credit: KPF*

To facilitate the introduction of cross-disciplinary teaching and research that will be adopted at HKUST(GZ), HKUST has launched a pilot scheme two years ago on the CWB campus, enrolling 109 and around 150 postgraduate students respectively for the first and second cohorts. Students are mentored by at least two supervisors from different disciplines to ensure cross-disciplinary thinking is adopted in their research. The campuses will also foster entrepreneurship and technology transfer in the Greater Bay Area (GBA) among students and faculty.

#### THE 7TH INNOVATION AND ENTREPRENEURSHIP COMPETITION OF STUDENTS OF GUANGDONG, HONG KONG, MACAO AND TAIWAN

Forty teams joined the Hong Kong area contest of the 7th Innovation and Entrepreneurship Competition in 2020, with four Hong Kong teams shortlisted to compete in the finals, including “Senior Deli” (an HKUST alumni team) participating in the college students category. The contest was sponsored by the Panyu District Government of Guangzhou, organized by Guangzhou University Town Management Committee and Guangzhou Science and Technology Finance Group Co., Ltd., and co-organized by the Nansha Guangdong-Hong Kong-Macao (International) Youth Entrepreneur Hub.

#### 2020 FOSHAN HKUST PROJECTS

In the 2020 round of the Foshan HKUST projects initiative, 12 projects under the University-Enterprise Collaborative R&D Program were approved, with RMB31.4 million total funding allocated. Under the Induction of Entrepreneurship Talents Program, nine projects were approved for funding, with a total of RMB3.6 million





allocated. The scheme is being offered by the Foshan City Government and Nanhai District Government, which are providing RMB35 million in funding annually from 2019 to 2023 to support Foshan HKUST projects.

### HKUST FOSHAN CENTER FOR TECHNOLOGY TRANSFER AND COMMERCIALIZATION OFFICIALLY OPENED



*HKUST Foshan Center for Technology Transfer and Commercialization located in Foshan opens in April 2021.*

In 2020-2021, the HKUST Foshan Center for Technology Transfer and Commercialization (FCTTC), situated in Sanlongwan Innovation Cluster, Nanhai, completed its initial construction and was put into trial operation in April 2021. FCTTC aims to strengthen the technological cooperation between Foshan City and HKUST, and assist in the transformation of scientific and technological achievements, innovation, and entrepreneurship incubation. Eleven incubation project teams have been successfully introduced.

### ENTREPRENEURSHIP INITIATIVES IN THE GREATER BAY AREA

HKUST Mainland platforms currently support a total of 70 start-up and spin-off companies and various entrepreneurial programs in the platform's respective locations available in Nansha, Shenzhen, and Foshan to assist the HKUST community in entrepreneurship activities in the GBA.

**Nansha:** The INCU-TECH Program (INCUB-TECH) is a government-industry-university-research collaborative project implemented by HKUST Fok Ying Tung Research Institute (FYTRI) in Nansha, Guangzhou. INCUB-TECH seeks outstanding applied research teams within the GBA and cultivates promising teams through seed funding, industry support, and market outreach. Research teams entering into the Program receive RMB700,000 seed funding from FYTRI. In June 2021, FYTRI gave an online introduction to INCUB-TECH for faculty, students, and graduates, with over 20 potential candidates indicating interest in the Program.

**Shenzhen:** Following the merger of Blue Bay, Blue Bay X, and the Entrepreneurship and Innovation Center at the HKUST Shenzhen Complex (IER2), the Blue Bay Incubator has successfully established an ecosystem that provides four schemes to support HKUST entrepreneurs and start-ups at different stages. In 2020-2021, Blue Bay set up a Shenzhen-Hong Kong channel for the Shenzhen regional contest in the One-Million-Dollar Entrepreneurship Competition, boosting the efficient exchange of innovation resources between Shenzhen and Hong Kong. The number of start-ups supported by Blue Bay reached 47 in 2020-2021. Blue Bay is a National Makerspace (國家備案眾創空間), accredited by the Ministry of Science and Technology.



*The Blue Bay Incubator has established an ecosystem comprising four schemes to support HKUST entrepreneurs and start-ups at different stages.*



*Shenzhen Unity-Drive Innovation Technology Co., Ltd. provides intelligent products for robotics, autonomous systems, smart logistics and transportation, among others.*

### Start-up Highlight: Shenzhen Unity-Drive Innovation Technology Co., Ltd. (UDI)

Founded by Professor LIU Ming, Department of Electronic and Computer Engineering and Department of Computer Science and Engineering, UDI, is a start-up focused on autonomous vehicles and logistics solutions. Incubated at Blue Bay, UDI was ranked in the 2020 Xinya Venture 50 and awarded the "Golden Autumn Award for Advanced Intelligent Vehicles" at the 2020 Advanced Intelligent Vehicle Annual Conference, held in Beijing.



## LOOKING FORWARD

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While the challenges of COVID-19 remained at the end of this reporting year in Hong Kong and around the world, many exciting opportunities lie ahead for HKUST. In particular, the pandemic's spotlight on the importance of technology, the diverse and innovative ways that technology can address challenges, and the multiple areas of life it now impacts through knowledge transfer add further impetus and timeliness to the expansion of HKUST in the Greater Bay Area (GBA) through the opening of its new campus in Guangzhou in 2022, and its research and entrepreneurship platforms in Nansha, Shenzhen and Foshan. The growth facilitated by the establishment of HKUST(GZ) involves not only greater numbers of students, faculty, and facilities, but its pioneering cross-disciplinary approach to education and research rolled out synergistically with activities at the Clear Water Bay campus. The industry engagements in GBA will be greatly enhanced with the presence of HKUST(GZ).

In line with HKUST's Strategic Plan 2021-2028, which encompasses both campuses, the University will thus seek to empower its knowledge transfer (KT) units to better coordinate resources and link faculty, students, and alumni with the University's research institutes and with industries in order to respond faster to emerging needs. This will also include KT units working with faculty leads to foster targeted relationships with government at all levels, leading industries, and non-governmental organizations.

Areas of particular future focus encompass: early identification of novel disruptive technology for industrial engagement; strengthening of intellectual property strategic management and commercialization; leveraging the Bridge Gap Fund (BGF) to support proof of concept and as a pipeline for Technology Start-up Support Scheme for Universities (TSSSU) companies; growth of the HKUST Entrepreneurship Fund (E-Fund) to build a larger investment pool and ecosystem for HKUST start-ups; further emphasis on improving start-up quality and DeepTech incubation and investment, among others. Dovetailing entrepreneurial education with the University's KT pipeline, fostering research collaborations with targeted industries and organizations, and nurturing the spirit of experimentation and innovation through the "campus as a living lab" concept are other priorities.

All of which bodes well for greater innovation, entrepreneurship, and social impact across Hong Kong, the GBA, and beyond.



## APPENDIX A – KEY PERFORMANCE INDICATORS

Performance Indicator	2019/20 (Achieved)		2020/21 (Achieved)	
Inventions, Patents, Licenses, IP, Contracts, and Services				
Number of invention disclosures received <sup>Note 1</sup>	147		176	
Number of patents filed in the year <sup>Note 1 &amp; Note 2</sup>	316		332 <sup>Note 3</sup>	
Number of patents granted in the year <sup>Note 1 &amp; Note 2</sup>	122		205 <sup>Note 4</sup>	
Number of patents used based on new contracts (according to contract date) <sup>Note 5</sup>	20		91	
Number of patents used based on active contracts (according to contract period) <sup>Note 6</sup>	241		327	
Number of new licenses granted in the year <sup>Note 7</sup>	8		23	
Number of total active licenses granted <sup>Note 7</sup>	113		120 <sup>Note 8</sup>	
Income (on cash basis) generated from intellectual property (IP) rights <sup>Note 9</sup>	\$9.8M <sup>Note 10</sup>		\$11.9M	
Number of collaborative researches, and income thereby generated <sup>Note 7 &amp; Note 11</sup>	132	\$550.9M	144	\$618.4M
Number of contract researches (other than those included in “collaborative researches” above), and income thereby generated <sup>Note 7</sup>	218	\$100.8M	221	\$111.5M <sup>Note 12</sup>
Number of consultancies, and income thereby generated <sup>Note 7</sup>	31	\$3.1M	59	\$6.2M <sup>Note 13</sup>
Number of equipment and facilities service agreements, and income thereby generated <sup>Note 7</sup>	594	\$5.5M	326	\$3.8M
Sub-total Income	\$670.1M		\$751.8M	

The figures reported for 2020-2021 are subject to year-end adjustments.

<sup>Note 1</sup> Starting from 2013-14, the number reported also includes invention disclosures, and patents filed, granted and used by Mainland platforms.

<sup>Note 2</sup> The numbers are counted based on the definition laid down by University Grants Committee (UGC) under the Common Data Collection Format (CDCF) according to the (1) number of countries of filings and (2) the number of patent types which is defined in accordance with the international patent classification (i.e. technology area) of the patents.

<sup>Note 3</sup> CDCF Table 65: The number of patents filed is 332 and the number of inventions involved is 223 during the period of 2020-21.

<sup>Note 4</sup> CDCF Table 66: The number of patents granted is 205 and the number of inventions involved is 98 during the period of 2020-21.

<sup>Note 5</sup> Number of patents used based on new contracts (according to contract date) refers to the number of patents utilized by means of licensing during the reporting period, including rights granted as background intellectual property (IP) in newly signed contracts with value according to the contract date. All used patents are only counted once if it is included in more than one contract.

<sup>Note 6</sup> Number of patents used based on active contracts (according to contract period) refers to the number of patents utilized by means of licensing during the reporting period, including rights granted as background IP in active contracts with value according to the contract period. All used patents are only counted once even if it is included in more than one contract.

<sup>Note 7</sup> Starting from 2017-18, the number reported also includes number of total active licenses granted, new licenses granted, collaborative researches, contract researches (other than those included in “collaborative researches”), consultancies, equipment and facilities service agreements, and income thereby generated by Mainland platforms.

<sup>Note 8</sup> The number reported also includes 101 patents and software license agreements, and 16 assignments on technology transfer managed by HKUST R and D Corporation Limited (RDC).

<sup>Note 9</sup> It includes both licensing incomes from patents via RDC, Mainland platforms as well as the copyright of courseware via the University. The period of reporting for copyright of courseware via the University is from 1 April to 31 March of the financial year as the data for 1 July to 30 June of the financial year are not yet available by the submission date of the Knowledge Transfer (KT) Annual Report.

<sup>Note 10</sup> The figures are adjusted due to year-end adjustment after the submission of KT Annual Report 2019-2020.

<sup>Note 11</sup> The number reported also includes number of InnoHK projects and income thereby generated.

<sup>Note 12</sup> The total number of new contracts and contract values of contract researches agreements signed in the 2020-21 period are 117 and \$115.7M respectively.

<sup>Note 13</sup> The total number of new contracts and contract values of consultancy agreements signed in the 2020-21 period are 52 and \$12.8M respectively.



Performance Indicator	2019/20 (Achieved)		2020/21 (Achieved)	
Entrepreneurial Education and Culture				
Number of teams for One-Million-Dollar Entrepreneurship Competition at the Clear Water Bay campus <sup>Note 14</sup>	151		185	
Number of teams for hackUST: Total Teams / HKUST Teams <sup>Note 15</sup>	83	55	184	91
Accelerator: Number of teams / Start-up companies <sup>Note 16</sup>	60		78	
Number of Teams / Start-up companies in the mentorHUB <sup>Note 17</sup>	65		150	
Number of students participated in entrepreneurship events <sup>Note 18</sup>	8,232		9,704	
Number of advising hours for student entrepreneurs	640		800	
Start-up and Spin-off Companies				
Number of start-up companies <sup>Note 19 &amp; Note 20</sup>	87		162	
Number of spin-off companies <sup>Note 19 &amp; Note 20</sup>	142		128	
Total number of start-up and spin-off companies	229		290	
Contributions to the Public				
Number of student contact hours in short courses or e-learning programs specially tailored to meet business or Continuing Professional Development (CPD) needs	1,850,205 hours <sup>Note 21</sup>		1,857,881 hours <sup>Note 22</sup>	
Income received from Continuing Professional Development (CPD) courses	\$699.3M <sup>Note 21</sup>		\$748.1M <sup>Note 22</sup>	
Number of public lectures / symposiums / exhibitions and speeches to a community audience	500		564	
Number of performances and exhibitions of creative works by staff or students	39		33	
Number of staff engaged as members of external advisory bodies including professional, industry, government, statutory or non-statutory bodies	485		500	

The figures reported for 2020-2021 are subject to year-end adjustments.

<sup>Note 14</sup> HKUST One-Million-Dollar Entrepreneurship Competition is one of Entrepreneurship Center (EC)'s annual flagship events. It is a platform for students and alumni to turn their business ideas into real business.

<sup>Note 15</sup> HKUST hackUST is one of EC's annual flagship events. It has also become one of the largest hackathon organized in Asia. Students from HKUST as well as other universities in Hong Kong create prototypes of hardware/software solutions over a weekend (non-stop) to solve real-life problems.

<sup>Note 16</sup> Accelerator includes funding programs and co-working space programs for HKUST start-up teams or companies, such as Yeung Wing Yee Entrepreneurs Fund (YWYEF); HKUST Entrepreneurship Acceleration Fund (EAF); and U\*STAR Award that has been administered by EC since January 2020.

<sup>Note 17</sup> A mentoring program tailored for co-founders of start-ups which was newly introduced in March 2020. By offering flexible and timely advice by mentors with a spectrum of professions, experience and resources, a more effective mentoring model is established and promotes start-up development.

<sup>Note 18</sup> Student participation in entrepreneurship events held by EC in the year (by headcounts).

<sup>Note 19</sup> It includes the economically active start-up and spin-off companies being funded or incubated by the HKUST entrepreneurship programs located in the Clear Water Bay Campus and Mainland platforms. The entrepreneurship programs include the HKUST Entrepreneurship Program (EP), Technology Start-up Support Scheme for University (TSSSU) Program, U\*STAR Award, Yeung Wing Yee Entrepreneurs Fund (YWYEF), HKUST Entrepreneurship Acceleration Fund (EAF), Alumni Endowment Fund (AEF) Student Start-up Grants, HKUST One-Million-Dollar Entrepreneurship Competition (regional competitions inclusive), HKUST Entrepreneurship Fund (E-Fund), companies under InnoHK; programs under the Blue Bay Incubator, Blue Bay X and Innovation & Entrepreneurship Center (I&E Center) of HKUST R and D Corporation (Shenzhen) Ltd. (RDCSZ) in Shenzhen; programs under the Guangzhou HKUST Fok Ying Tung Research Institute (FYTRI) in Nansha; and programs under HKUST Foshan Research Institute for Smart Manufacturing (FRISM) in Foshan. For companies funded or incubated by more than one program or having offices in more than one location are only counted once.

<sup>Note 20</sup> The period of reporting is from 1 January to 31 December of the calendar year as per UGC under the CDCF requirement.

<sup>Note 21</sup> Starting from 2017-18, the number reported also includes taught postgraduate programs (including EMBA, MBA, MSc, MA, PgD) with reference to the definition of Continuing Professional Development (CPD) courses laid down by UGC under the CDCF. As the compiled income of the programs above for 2019-20 are not yet available by the submission date of the KT Annual Report, the data for KT Annual Report 2019-20 was reported based on the data collected in 2018-19.

<sup>Note 22</sup> Starting from 2017-18, the number reported also includes taught postgraduate programs (including EMBA, MBA, MSc, MA, PgD) with reference to the definition of Continuing Professional Development (CPD) courses laid down by UGC under the CDCF. As the compiled income of the programs above for 2020-21 are not yet available by the submission date of the KT Annual Report, the data for KT Annual Report 2020-21 was reported based on the data collected in 2019-20.





## APPENDIX B – OTHER ACTIVITIES HIGHLIGHTS

### 1. Fighting against COVID-19

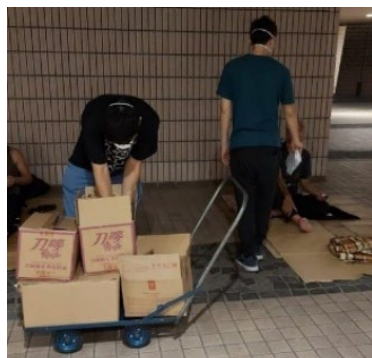
#### HELPING TO DEBUNK COVID-19 MYTHS WITH SCIENCE

A team of researchers at HKUST's Center for Artificial Intelligence Research (CAiRE), led by Professor Pascale FUNG, Department of Electronic and Computer Engineering (ECE), built CAiRE-COVID for mining scientific literature on COVID-19 and debunking virus myths. The machine learning-based system leverages top natural language processing (NLP) question-answering techniques, combined with summarization. CAiRE-COVID also aims to assist the medical community in finding answers to COVID-related queries and ultimately a cure.



*Professor Pascale FUNG and her team at HKUST's Center for Artificial Intelligence Research (CAiRE) build CAiRE-COVID in response to the COVID-19 Challenge.*

#### HELPING HAND FOR THE NEEDY

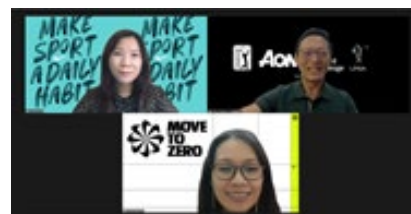


*Ryan FUNG Kei-Ning, an HKUST Year two business student, along with staff of the Salvation Army Integrated Service for Street Sleepers bring food and daily necessities to the homeless up to three times a week.*

HKUST students set their innovation and caring spirit to work on behalf of the community in diverse ways during COVID-19, including during internships. For example, a business student Ryan FUNG Kei-Ning and other staff at the non-governmental organization (NGO) providing his internship had to reduce their outreach to distribute food and necessities to the homeless during Hong Kong's third wave of COVID-19 cases. Instead, he rapidly turned to compiling a list of community centers where the homeless could temporarily stay and managing the NGO's social media page to raise public awareness of the additional plight of these people during the pandemic. Meanwhile, Carina YIP Fung-Ting, a biological science student, was inspired during her internship at an elderly center to use her knowledge and creativity to produce videos to share essential health tips on protection against COVID-19 with the seniors.

#### GENERATING A RESILIENT MINDSET TO BOOST BUSINESS LEADERSHIP DURING THE PANDEMIC

The Kellogg-HKUST Executive MBA (EMBA) Program invited its community members, ranging from faculty members to alumni industry leaders, to conduct 10 webinars on guiding a team through disruptive times. The webinars tackled issues from both academic and practical perspectives, providing a platform for senior executives to develop a resilient mindset. Non-HKUST EMBA corporate leaders also took part.



*Industrial leaders share their tips on how to remain resilient in times of difficulty.*



## DISINFECTION TECHNOLOGIES CONTRIBUTING TO PUBLIC HEALTH

The HKUST-CIL Joint Laboratory on Environmental Health Technologies, led by Professor YEUNG King-Lun, has developed a series of innovative technologies to address the adverse impact of pollutions and microbial contaminations on public health and the environment. The team's smart antimicrobial technologies focused on disinfection of air, water and surfaces, providing long-term sustained disinfection against pathogens with effective infection control capabilities. Three of the technologies have been successfully commercialized, and the team's effort was recognized with the Chief Executive's Commendation for Community Services in Hong Kong's 2020 Honor List for Professor YEUNG's contributions to fighting against COVID-19. In addition to this significant recognition, the research team's contribution to the territory-wide Research Assessment Exercise 2020, "Environmental Health Technologies for Healthy Living", received a 4-star rating as "world-leading" research with remarkable impact in terms of reach and significance.



*Professor YEUNG King-Lun is awarded the Chief Executive's Commendation for Community Service.*



## **2. Reinforcing Industrial Engagement and Collaboration**

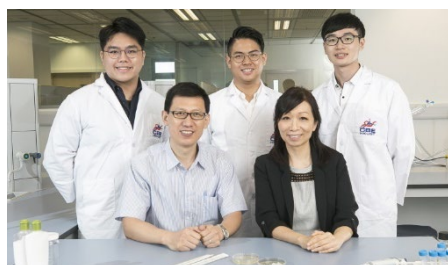
### **OCCUPATIONAL SAFETY AND HEALTH TRAINING FOR HOSPITAL AUTHORITY**

HKUST's Health, Safety and Environment Office provided a series of occupational safety and health (OSH) training sessions, encompassing lectures and practical fieldwork, to the Hospital Authority Head Office's OSH core team, cluster OSH coordinators, and supporting personnel. Sessions set out to equip participants with occupational hygiene technical knowledge and practical skills to deal with OSH hazards in the workplace, and to evaluate the effectiveness of hazard control measures. Topics included exposure assessments for hazardous chemicals and design and management of specialized ventilation systems in healthcare buildings.



*The Health, Safety and Environment Office delivers an occupational safety and health training on chemical exposure assessment and ventilation in healthcare environment to Hospital Authority staff.*

### **STUDENTS, FACULTY AND ALUMNA WORK TOGETHER ON SANITIZING HAND CREAM COMMERCIALIZATION**



*Alumna Vanessa HO Po-Ki (right, first row), Prof. Marshal LIU (left, first row), and three BEng fresh graduates (from left, second row) Andy CHOY Man-Hin, Isaac KWAN Chi-Shing and Michael LUI Wing-Piu, join hands to achieve product commercialization of an idea that originated in a course project.*

With health a leading concern in 2020 due to COVID-19, final year Chemical and Biological Engineering (CBE) students Andy CHOY Man-Hin, Isaac KWAN Chi-Shing, and Michael LUI Wing-Piu, developed a sanitizing hand cream for their product and process design course, under the guidance of CBE faculty member Professor Marshal LIU. Leveraging departmental links further in a fruitful knowledge transfer collaboration, the students went on to bring the product to market through the assistance of CBE alumna-entrepreneur Vanessa HO Po-Ki.

### **DELOITTE CHINA “BEST MANAGED COMPANIES” PROGRAM**

Deloitte China and the School of Business and Management (SBM), the sole academic partner of Deloitte China's “Best Managed Companies (BMC)” Program, jointly announced the awardees in the second BMC Program in August 2020. The second BMC white paper was also released, providing analyses of China's business environment and management practices in the post-pandemic era. SBM provided additional support by publishing a series of related thought-leadership articles and interactive webinars. Deloitte BMC is a global initiative that recognizes private companies with excellent management and business performance.



*The HKUST Business School joins the “Best Managed Companies (BMC)” ceremony online.*



### COLLABORATION WITH COMPANIES IN CASE EXPANSION

The HKUST Thompson Center broadened its collaboration with industry to develop cases on a wide range of companies, for example, China Construction Bank, Chow Tai Fook Jewellery Group, and Germagic Biochemical Technology Co., Ltd. Such cases can be used in many HKUST classes and training programs, providing students with field research from real-world companies. Case protagonists were also invited to the class to share their experiences and perspectives with students.



Field visit to Germagic Biochemical Technology Co., Ltd.'s (GBT) production site for the GBT case in March 2021.

### TANOTO CENTER PUBLICATIONS IN SIMPLIFIED CHINESE ON WECHAT

During 2020, a collection of publications in simplified Chinese was built up on the Tanoto Center for Asian Family Business and Entrepreneurship Studies' official WeChat account. The two main categories focus on family offices and family businesses. Items include columns published in the *Hong Kong Economic Times*, *Hong Kong Economic Journal*, *Family Office Times*, *China Family Business Review*, and other media, as well as research reports and special issues produced by the Center.

### HKUST AND CHINA CONSTRUCTION BANK CO-ORGANIZE FINTECH MASTER PROGRAM



Professor Wei SHYY, President (left) and Professor WANG Yang, Vice-President for Institutional Advancement represent HKUST at the signing ceremony.

In a forward-looking academic-industry collaboration, a Memorandum of Understanding was signed between HKUST and China Construction Bank (CCB) to co-organize a Master's degree program in Financial Technology to nurture financial talents and foster connectivity between Hong Kong and the Mainland. Students can enroll in courses at HKUST's Clear Water Bay campus and CCB's South China Campus, participate in exchange visits and undertake internship training. Future joint endeavors include a mini-MBA program for owners of small and medium-sized enterprises and activities such as entrepreneurship competitions.





### 3. Engaging the Community (KT-related Social, Community, and Cultural Engagement Activities/Services)

#### **POLICY DIALOGUE SERIES 2020-21 FEATURING PROFESSOR ANTHONY CHEUNG**

The HKUST Division of Public Policy and the Department of Asian and Policy Studies, the Education University of Hong Kong co-organized the Policy Dialogue Series featuring Professor Anthony CHEUNG Bing-Leung (張炳良教授) as principal speaker. Joined by eight other professors and speakers, the two universities cooperated again to host six online dialogue sessions, covering social to political issues to explore contemporary public policy challenges facing Hong Kong. Over 540 members of the public and the organizing institutions participated in the series.



*(Left to Right) Professor Stephen CHIU, Ms. Sharon CHEUNG, Professor Anthony CHEUNG and Dr. Isabella NG attend the Policy Dialogue “The Fury of Young People: Aspirations, mobility, and identity politics”.*

#### **HKUST ARTS FESTIVAL 2021**



HKUST Arts Festival 2021 (AF2021) returns with the theme “Art, Despite the Pandemic”, bringing a series of programs including multimedia exhibition, live performances and workshops to the campus.

With a theme of “Art, Despite the Pandemic”, the HKUST Arts Festival 2021 (AF2021) brought fresh cheer to the campus through a collection of engaging and interactive programs. An exhibition on the cultures of Central Asia, the Caucasus, and the Middle East was the focal point, featuring over 40 musical instruments, traditional costumes, and handmade carpets from these regions. The show merged the traditional display of exhibits with technology innovation to deliver a multisensory experience in anticipation of advanced audio-visual facilities to be installed in the new Shaw Auditorium. As well as viewing the physical items, visitors could “try on” different costumes through digital cosplay, “paint” a carpet, and “play” musical instruments via multimedia installations. The return of live music performances was another festival highlight.

#### **CASE STUDIES AND CASE COMPETITION FOR SOCIAL SCIENCE AND PUBLIC POLICY**

To enhance social science teaching, learning, and research, and with the support of the HKUST Teaching Development Grant, in 2019, case studies started to be developed on pressing social and public policy issues in Hong Kong and the Mainland in four clusters: (1) science, technology, and innovation; (2) environment and sustainability; (3) social changes; and (4) China’s development. The project hosts two sessions of the HKUST Inter-University Public Policy Case Competition in 2019 and 2021, engaging 150-200 student participants from six higher education institutions in Hong Kong. Participants are required to analyze prescribed case studies and devise solutions for resolving social and policy problems. An online case library with 20 case studies is currently available to the public for viewing and downloading, and the number shall grow to around 30-35 in the coming year.



*The Institute for Public Policy and the Division of Public Policy host the Inter-University Public Policy Case Competition 2020 to provide a hands-on opportunity for students to analyze and resolve real-life public policy problems through case studies.*



### HONG KONG'S FISHING COMMUNITIES: SUSTAINABLE FISHERIES AND RELATED INDUSTRIES IN AN URBAN SETTING

This project involved questions to Hong Kong fishers about their sustainable fishing practices, difficulties in maintaining their livelihoods in such a high cost-of-living situation, and dilemmas of maintaining their community. The research was not only crucial to fishers and other societal stakeholders, but also brought their voices into academic policy papers and the popular press.

### THE INAUGURAL CONFERENCE OF THE ASSOCIATION FOR CHINESE ANIMATION STUDIES



*The Inaugural Conference of the Association for Chinese Animation Studies is a webinar conference with 19 panels held from March to May 2021.*

Professor Daisy DU, Division of Humanities and General Editor of the Association for Chinese Animation Studies, organized the Inaugural Conference of the Association for Chinese Animation Studies, a webinar conference with 19 panels from March to May 2021. More than 80 professional animators and over 1,000 public guests participated.

### ENVIRONMENT AND CONSERVATION FUND EMBRACE BLUE LANTAU

This project, with support from the Hong Kong government's Environment and Conservation Fund, sought to promote the high ecological values of Lantau's coastal areas and the importance of biodiversity and conservation. Running from July 2019 to November 2020, over 70 students from HKUST and other sister universities were recruited for the project and around 2,000 participants joined the activities. It also produced a list of publicity and education materials to facilitate people's learning in relation to biodiversity, and videos introducing different coastal habitats on Lantau.



*Environment and Conservation Fund Embrace Blue Lantau Project is organizing closing activities on 29 November 2020, including rich content such as talks on ecology, board game and video sharing.*

### STEM + E 2021



*The STEM+E connects HKUST Business School with the high school community and provides a precious platform for students to brush up on their business acumen and expand professional network.*

Organized by the STEM+E Consortium comprising members from the School of Business and Management, Hong Kong Science and Technology Parks Corporation, and six prominent local secondary schools, the STEM + E exposed students to innovative technologies, pain points, and key challenges faced by environmental protection initiatives, and technology commercialization and adoption. The pioneering program has helped cultivate an innovation and entrepreneurship culture among secondary students since 2018-19. The program has evolved into a territory-wide program that benefited over 300 secondary school students from over 51 secondary schools and collaborated with 10 start-ups in 2021.



## MOBILIZING CAPITAL FOR THE BROWN TO GREEN TRANSITION: PANEL OF CATALYZERS

In January 2021, a group of Hong Kong-based leaders in green finance shared valuable insights in a webinar on “Mobilizing Capital for the Brown to Green Transition: Panel of Catalyzers”. Moderated by Christine LOH, Chief Development Strategist at HKUST Institute for the Environment, the panel featured Annie CHEN (RS Group); Bénédicte NOLENS (BIS Innovation Hub, Hong Kong Centre); Elsa PAU (WealthAsia Group); Pratima DIVGI (CDP); and Professor Entela BENZ (Department of Finance). Panel members shared their diverse experience in applying a green and sustainability lens in financing and investment work, and their views on the latest development for blended finance structures for Hong Kong and the region.



*A group of Hong Kong-based leaders in green finance share valuable insight in the webinar titled “Mobilizing Capital for the Brown to Green Transition: Panel of Catalyzers”.*

## FINTECHSTIC – AN EDUCATION EVENT FOR HONG KONG FINTECH WEEK 2020

The School of Business and Management organized “Fintechstic”, a series of educational events for Hong Kong Fintech Week 2020, the biggest annual fintech conference in Hong Kong, to encourage business sector development of fintech talent and provide fintech insights to the public. Activities included an interactive online quiz, workshops, and a case competition. The School’s event partners comprised Hong Kong Telecom, a major telecommunications company, and Gini, a local fintech start-up.



*Fintechstic is an event of the Fintech Education Series of Hong Kong Fintech Week 2020, with training from industry players and a real world business case challenge designed for the next generation to play a leading role in the fintech industry.*

## BIZINSIGHT@HKUST WEBPAGE DEVELOPMENT



*The School of Business and Management develops a new webpage called BizInsight@HKUST.*

The School of Business and Management launched its BizInsight@HKUST online platform to showcase its faculty’s research and enable more people to learn about it. The platform features talks, studies, and animated videos, among others, with a particular emphasis on work that demonstrates how business research can impact society.



## HKUST DIVISION OF INTEGRATIVE SYSTEMS AND DESIGN STUDENTS DESIGN CONCEPTS FOR FUTURE TRAMS

Division of Integrative Systems and Design undergraduates collaborated with Hong Kong Tramways on an innovative eco-friendly project entitled “Trams in the Hong Kong Transport System: Designing the 8th-generation Tram for Low-carbon Transport Futures”. Students carried out research and undertook designs with the potential to contribute to the realization of low-carbon transportation.



*HKUST Division of Integrative Systems and Design has collaborated with Hong Kong Tramways to hone students' critical thinking in approaching complex problems in society, particularly those related to the global challenges of climate change.*

## THE MAY 50K CAMPAIGN TO KISS MULTIPLE SCLEROSIS GOODBYE



*Kellogg-HKUST members run or walk 50K across four continents to raise funds and awareness for multiple sclerosis.*

The Kellogg-HKUST Executive MBA community ran or walked a total of 2,565km in four continents throughout May 2021 to raise awareness and funding for research in multiple sclerosis (MS). Within a month, members managed to raise a total of £12,420 for the Multiple Sclerosis International Federation (MSIF). Over 2.8 million people worldwide have been diagnosed with MS.

