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香港理工大學

POLYU Academy FOR Interdisciplinary RESEARCH

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Please don't miss our first PAIR Conference 2023 from 8 to 11 May 2023!

PAIR Newsletter

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Contents

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Chief Editor's Corner

Prof. CHEN Qingyan
Director of PolyU Academy for
Interdisciplinary Research

A Happy New Year to you all. I hope you celebrated the start of 2023 safely and in good spirits. This fifth issue is the first PAIR newsletter released in 2023. With the gradual opening of the Hong Kong border and the resumption of face-to-face activities, various university developments at PolyU have gained momentum. The Academy has been busy planning for and developing a number of important initiatives, particularly the first PAIR Conference which will be held 8–11 May 2023 in hybrid mode at PolyU.

The four-day PAIR Conference, under the theme of "Research Excellence for Societal Impacts", could be the first and largest event in 2023 dedicated to interdisciplinary research and development in Hong Kong higher education. It will provide a platform for professional exchange and closer collaboration among stakeholders from industry, academia, and governments around the world. The conference activities will include plenary, keynote, technical, poster, and panel discussion sessions and lab visits.

You are strongly encouraged to learn about and join the Conference, submit abstracts to the remaining slots of the poster sessions, and extend our invitation to your friends, colleagues and business partners. I am confident that the Conference will be an excellent opportunity for a meet-and-greet and productive exchange among the PolyU family, professional communities in Hong Kong, eminent speakers, important partners and interested members of the public. Please stay tuned for event updates, and visit the conference website at www.polyu.edu.hk/pairconference2023. The conference participation is free.

A major highlight in this issue is our "Feature Stories" section, which includes a narrative interview with Prof. David Cardwell, Pro-Vice-Chancellor (Strategy and Planning), The University of Cambridge, who described the future direction of university teaching and research. I hope the discourse will inspire education leaders and administrators to reflect on the existing practices in university development and management and gear up for the challenges ahead in education. Our coverage of the Research Institute for Sustainable Urban Development (RISUD) and the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE) describes PolyU's endeavours to address sustainability challenges.

In early 2023, we invited the 2020 Nobel Laureate in Physics, Prof. Reinhard Genzel, to present a PAIR Distinguished Lecture. Prof. Genzel shared his 40-year journey in studying the mass distribution and discovering a supermassive compact object at the centre of the Milky Way galaxy. We also welcomed digital health entrepreneur and father of modern surgical robotics, Dr Wang Yulun, who shared about the development of telemedicine and technology-enabled remote health care in a PAIR Public Seminar. Our "News & Events" section will give you more insights, and you are always welcome to view our lectures and seminars at www.youtube.com/@pairpolyu3024.

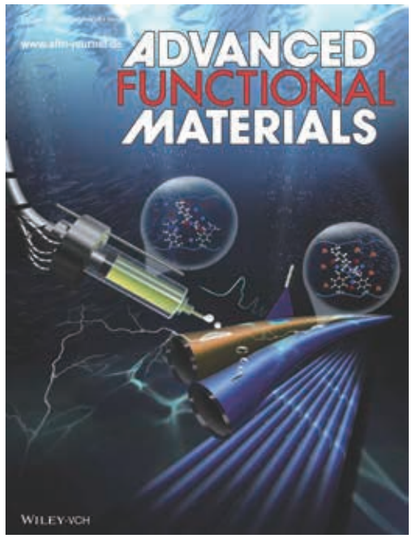
Last but not least, we hope our "Research Achievements" and "Knowledge Transfer" sections will spark your curiosity and spur innovation. These sections cover various novel inventions and scientific endeavours at PAIR, including an underwater adhesive, flood risk assessment, optical characterisation technology, structural deformation detection, and spectacle lenses for myopia control. Meanwhile, our "People" section covers some of the regional and international honours bestowed upon PAIR researchers for their scientific contributions.

Thank you very much. I hope you enjoy reading Issue 5 of the PAIR newsletter. I look forward to meeting you, both in person and online, at the forthcoming PAIR Conference at PolyU.

Prof. CHEN Qingyan
Director of PolyU Academy for Interdisciplinary Research

Research Achievements

New adhesive for underwater work



Dr FU Jimin, Member of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), and his collaborators designed a polymeric glue which is a promising adhesive material for underwater repair and follow-up crack monitoring.

The glue was developed on the basis of triazole-beared macromolecules and ionic liquids. It is highly conductive and exhibits rapid, strong and long-lasting underwater adhesion on diverse substrates in various harsh environments and at extreme temperatures. The glue's fluorescence and molecular recognition ability make it suitable for underwater labelling and sensing.

Developing a conductive underwater glue is challenging because the fluidity of the glue favours adhesive spreading and yet leads to leakage. The polymeric glue was designed to address this problem. The triazole-beared macromolecules of the glue serve as underwater binding sites, while ionic liquids (ILs) are used as the solvent for fast water exchange that triggers rapid adhesion. The binding between the polymer and ILs is controlled so that sufficient ILs within the adhesive are retained for sensing.

The glue can be used for underwater sealing and in situ monitoring of various physical signals, while its fluorescence can be utilised for underwater labelling. The design strategy for this polymeric glue provides a new direction for next-generation multifunctional underwater adhesives.

This research was published on the inside front cover of *Advanced Functional Materials* (https://doi.org/10.1002/adfm.202270248).

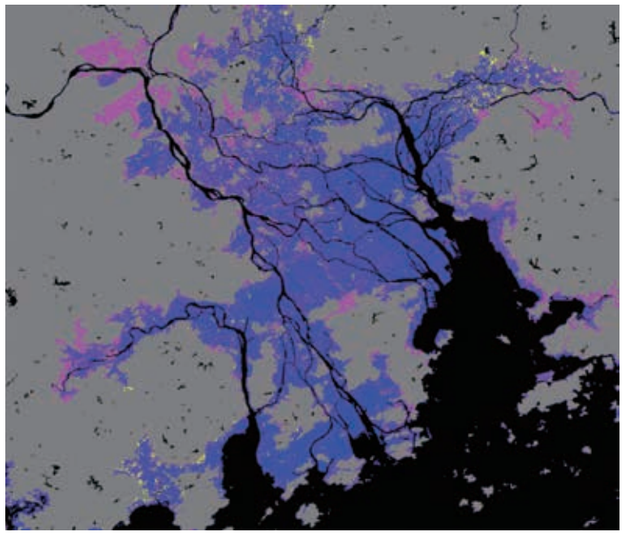
Assessing climate change-induced flood risk within the Greater Bay Area

Dr DUAN Huanfeng, Member of the Research Institute for Land and Space (RILS), and his research teams in Hong Kong and on the inland are working on a project to investigate the patterns and characteristics of joint occurrences of coastal rainstorms and storm surges, thereby assessing the flooding risks in the GBA. The project was awarded funding of HK$1.24 million under the National Natural Science Foundation of China (NSFC)/Research Grants Council (RGC) Joint Research Scheme (JRS) 2022/23.

City cluster (9+2 cities) in the GBA of China

About 15–28% of coastal residential areas in the Greater Bay Area (GBA) are expected to be flooded in 2100 due to extreme weather events associated with climate change. This situation highlights the significant need for flood risk assessment in the GBA.

The project aims to study the underlying patterns of rainstorm-storm surge joint occurrences in the coastal regions of the GBA, and the physical mechanisms of coastal flooding caused by compound climate and weather events in the area. A comprehensive methodology including statistical analysis, numerical simulation, and laboratory and field tests will be used. The project is expected to facilitate flood management plans in the GBA, and provide useful references of urban flooding mitigation and prevention for other coastal regions.



Predicted land areas below flooding water level in the GBA in 2100
(The blue and pink colors refer to current land areas that are expected to be below water level when different factors are considered.)

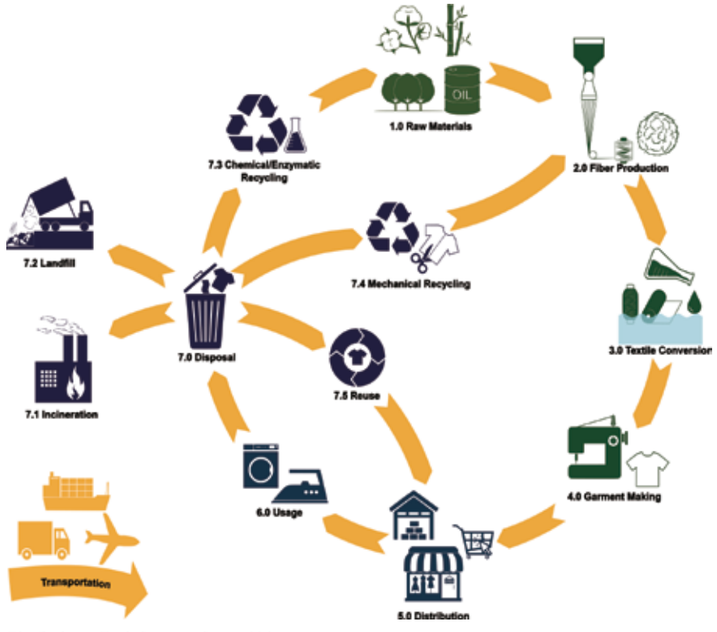
Advancing life cycle sustainability of textiles through technological innovations

An international team led by Prof. TAO Xiaoming, Director of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), recently published an invited review article titled "Advancing life cycle sustainability of textiles through technological innovations" in *Natural Sustainability*.

Throughout their life cycle, textiles produce 5–10% of global greenhouse gas emissions, release polluting microplastics and chemical agents that contaminate waterways, and consume the second-largest amount of the world's water. Prof. Tao's team and Dr Svetlana BORISKINA of Massachusetts Institute of Technology joined forces for a two-year assessment study on the environmental impact of technological innovation.

The team conducted a systematic analysis of state-of-the-art technology developments meant to solve sustainability problems in the fashion industry. They collected 22,724 publications published during the last ten years, among which 940 were screened and 215 were studied in detail.

Based on their findings, the team discussed the future directions of research and development along which green transformation of textiles could be accelerated. These include identifying and developing sustainable replacements for synthetic polyester and nylon fibres, developing biomass-based and degradable fibre-forming materials, cultivating insect- and disease-resistant plant seeds that require less water, advancing biological science, waterless or less-water colouration, reducing or eliminating production steps, and designing products with a single type of textile.



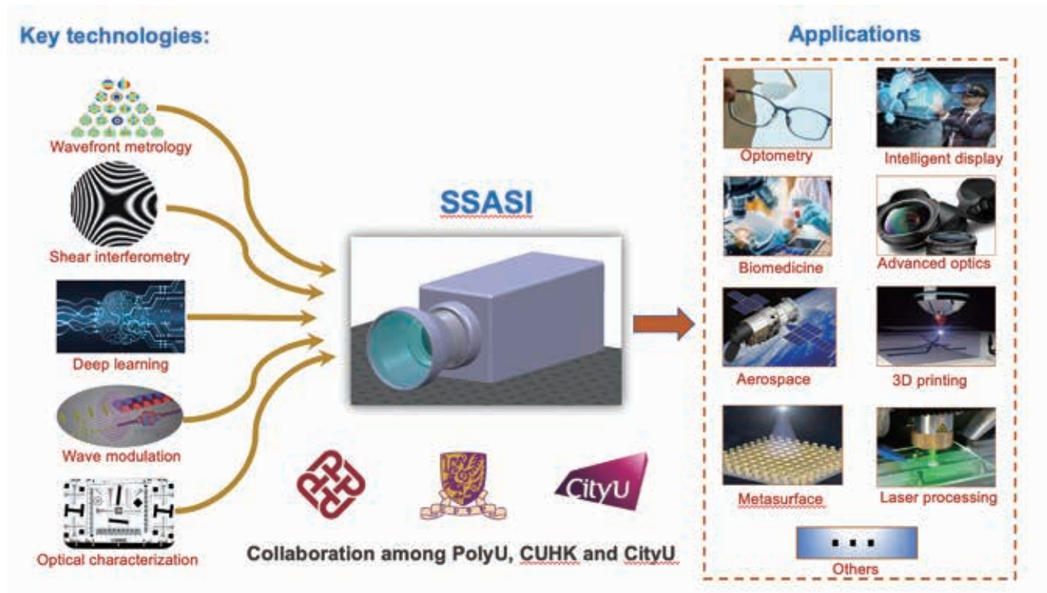
Fibre Production Textile Conversion Garment Making

Tripartite project to develop smart system for optical characterisation

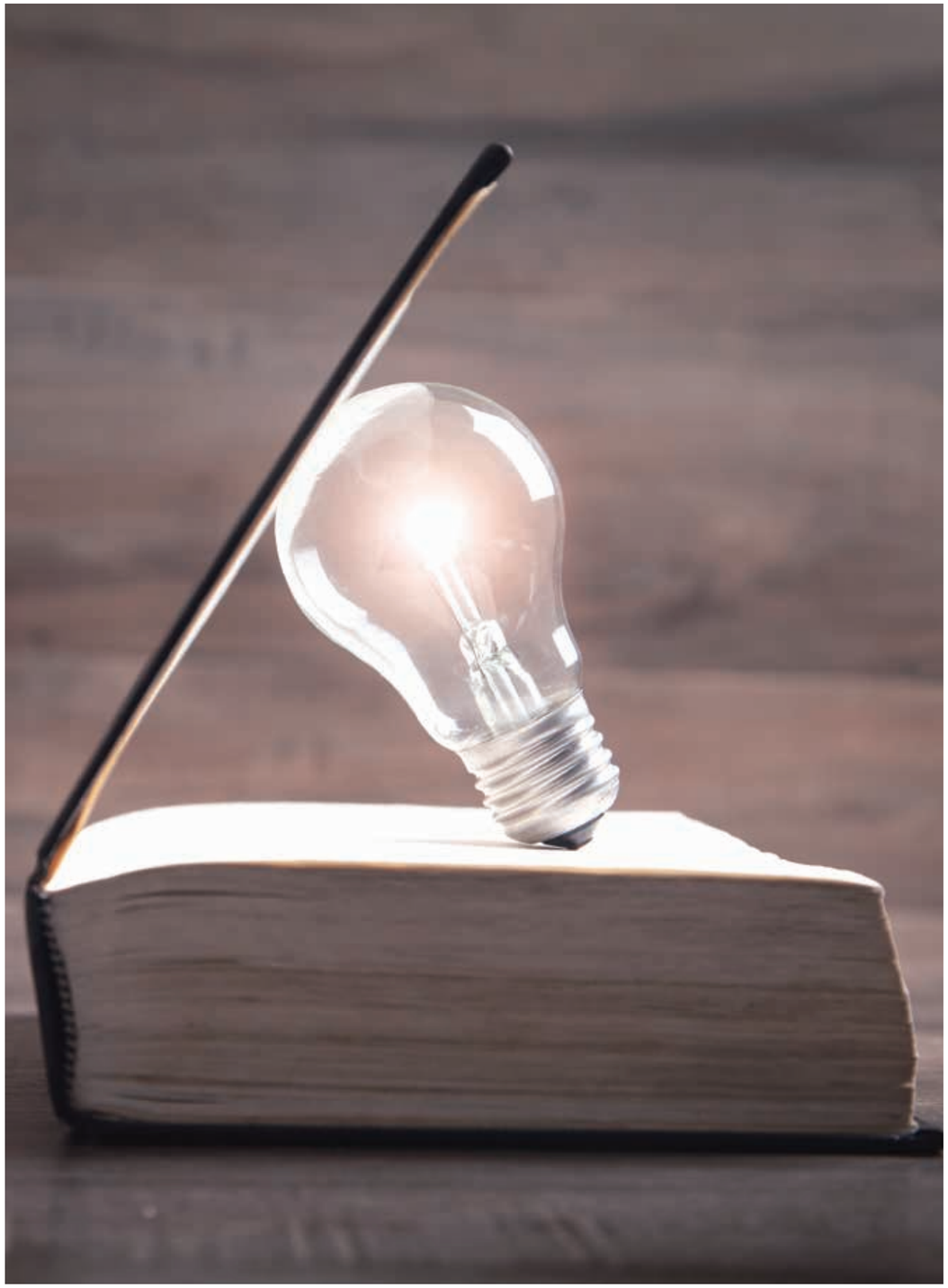
Prof. Benny C.F. CHEUNG, Director of the State Key Laboratory of Ultra-precision Machining Technology and Associate Director of the Research Centre for SHARP Vision (RCSV), is leading an inter-institutional research project which aims to develop a novel smart self-adaptive shear interferometric (SSASI) system for optical characterisation.

The SSASI system is a specialised instrument that uses the wavefront of light to comprehensively measure the properties of materials. Whereas existing devices only measure optical parameters that are specific to optical characterisation for certain fields, the SSAI system enables the measurement of multiple optical properties within a single system. It will help technology companies evaluate surface imperfections (e.g., scratches, pits and dings) and validate the surface quality of the critical optical components used in their products.

The inter-institutional project has been granted the Collaborative Research Fund (CRF) 2022/2023 by the University Grants Committee, with support totalling HK$4,267,120. Each of the three participating institutions will develop specific research applications for the system. The School of Optometry and Research Centre for SHARP Vision at PolyU will work on optical characterisation of defocus spectacle lenses for human myopia control in optometry and ophthalmology. The Chinese University of Hong Kong will focus on laser beam quality and beam shaping for two-photon processing. The City University of Hong Kong will focus on optical characterisation of metasurfaces. The project will bring scientific advances to precision metrology, material science, optical engineering, and measurement science and technology.



Different configurations of the smart self-adaptive shearing interferometric (SSASI) system for different inter-institutional research applications

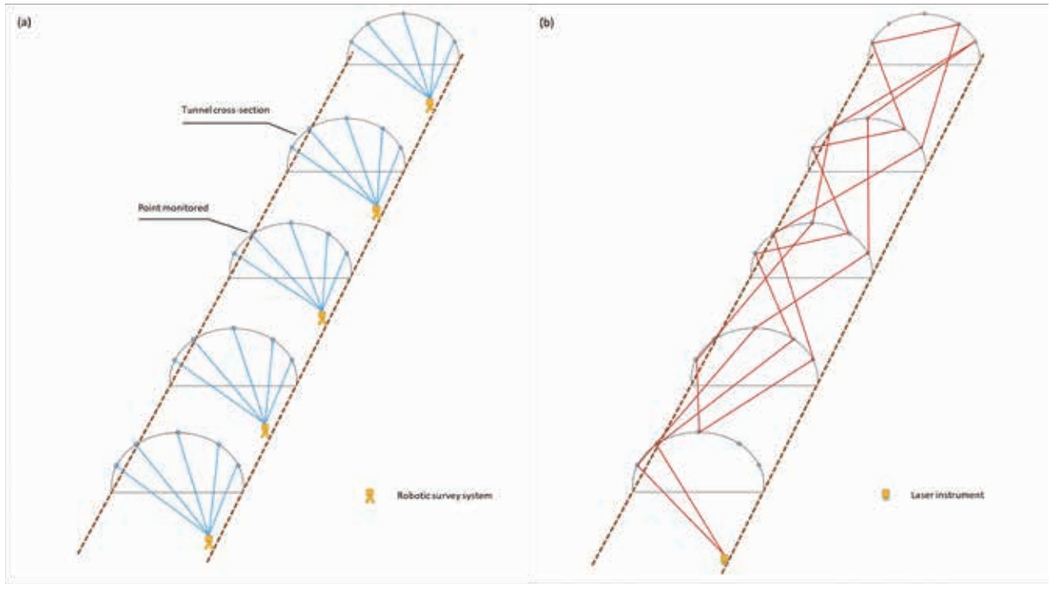


Real-time multi-point displacement monitoring to detect structural deformation

Infrastructure components such as tunnels suffer from deformation, and anomalous deformation behaviour may lead to structural failure and hazards. Deformation monitoring systematically measures and tracks the changes in shape and dimensions so that appropriate actions can be taken to mitigate possible risks.

A research team led by Prof. DING Xiaoli, Director of the Research Institute for Land and Space (RILS), developed a new technology for measuring structural deformation. Typically, a robotic survey system has been used to take sequential measurements at certain points along a long tunnel (Fig. (a)), to determine the displacements of the measured points and hence the deformation pattern of the tunnel. In contrast, the new technology uses a laser instrument and reflectors that direct a laser beam to multiple points (Fig. (b), for example), and accurately detects the displacements of measured points along the travel path of the laser.

This method provides a new alternative to the traditional, costly and time-lapse approach which requires many survey systems moving around in the tunnel and taking section-by-section measurements in order to provide a full set of measurements. The technology is now mature and can be used to monitor deformation of various structures such as tunnels, bridges, buildings and slopes with higher efficiency, lower cost, and in real time.



RCSV researchers launch innovative spectacle lens to slow myopia progression in children

The Vision Science and Technology Co. Ltd. (VST), a PolyU-supported start-up, has successfully developed the Nano Multi-rings Defocus Incorporated Lens, offering children and adolescents a convenient, non-invasive and effective way to delay myopia progression. VST collaborated with the State Key Laboratory of Ultra-precision Machining Technology (The Hong Kong Polytechnic University) (SKL-UPMT), the Research Centre for SHARP Vision (RCSV) and the School of Optometry of PolyU to create the new spectacle lens by integrating PolyU's proprietary technology—Defocus Incorporated Soft Contact (DISC) technology and Ultra-precision Nano Multi-rings Machining technology. The new lens will soon be rolled out in Hong Kong and on the inland. The company will continue collaborating with PolyU to develop new myopia control products based on DISC technology to protect the vision of children and adolescents.

Founded by PolyU's professors and alumni, VST has received financial support from the PolyU Micro Fund and the PolyU Tech Launchpad Fund. In 2018, VST secured a licence from PolyU to commercialise DISC technology. VST manufactures and distributes DISC lenses at its authorised optometric clinics and fitting centres.

A dialogue with Professor David CARDWELL of Cambridge: Reflections on the future of global higher education

In May 2022, PAIR was honoured to have invited Prof. David CARDWELL, Pro-Vice-Chancellor (Strategy and Planning) of the University of Cambridge, to speak on "The Future of Global Universities" in an online PAIR Distinguished Lecture. With the gradual re-opening of the Hong Kong border, PAIR was pleased to welcome Prof. Cardwell for an in-person visit to PolyU in January 2023.

PAIR chatted with Prof. Cardwell about the way forward for global higher education and his vision for learning, research and engagement.

The future of teaching and learning in higher education

In the Distinguished Lecture, you explained that the international differences and East-West divide in pre-university education systems create challenges to global higher education. What can universities do to better cater to learning diversity and ease students' transition to tertiary education?

> **"It can be challenging for students with local education qualifications obtained in their home countries to succeed in applying to prestigious universities in other countries because of a skills and knowledge mismatch."**

This is about students making an informed decision on an education choice that is suitable for them. Unfortunately, differences in education systems are unavoidable, so there are applicants and high school graduates whose attributes and skills may not be compatible with the universities at which they want to study. Many students realise far too late the track they should have taken in education and training, as well as the actions needed to achieve their academic and life goals. As an example, most students taking the General Certificate of Education Advanced Level (GCE A Level) in the British education system study three subjects, while the National College Entrance Examination (NCEE, also known as Gaokao) in inland China tests students on more subjects (i.e., six subjects under the 3+3 model). Students in different education systems therefore develop different breadths and depths of knowledge, as well as types and levels of skills. It can be challenging for students with local education qualifications obtained in their home countries to succeed in applying to prestigious universities in other countries because of a skills and knowledge mismatch. It is not only about being admitted by the best college, but by one that is the most appropriate for the student.

In 21st-century education, development of the 4C skills (communication, collaboration, critical thinking and creativity) is emphasised, so that students can participate in today's global community. How does this impact teaching and learning in higher education?

> **"What educators can do is embed the 4C (communication, collaboration, critical thinking and creativity) skills into students' learning and monitor their development of these skills."**

What educators can do is embed these skills into students' learning and monitor their development of these skills. However, we have to remember that possessing these skills alone does guarantee a valuable contribution to society. Students also need specialised and elite knowledge in certain subjects in order to change the world.
Communication skills in conducting research, preparing and delivering presentations, working in teams, ethics and ethical awareness, and the appropriate reporting of references sources used are all skills useful throughout life. Institutions can integrate these elements into courses and continually test them as the curriculum develops. It should be possible to assess how well their general skills are improving as students go through their university studies. Interestingly, students from an examination-oriented education system tend to do less well on teamwork. The traditional method is: a teacher stands up, puts a problem on the board, and solves it; students learn it, go away, are tested, and are deemed to have learned certain knowledge if they get the answer right. Educators can flip this around by using a different approach, such as problem-based learning (PBL). An alternative method is: a teacher presents a problem to students; the students go away, find their own solutions in teams, and present their solutions. Personally, I would rank communication and teamwork as the top life skills need by students. With effective communication skills, students will be able to explain to teachers and peers their understanding of key issues and challenges in the external environment, including proposing solutions based on a collective, peer-informed understanding of the problem.

What are some of the key challenges to teaching and learning in higher education?

> **"The pandemic has taught us that some things in education, like the environments for teaching, learning and examinations, can vary."**

There is an awful lot here. COVID-19 has changed the world, but examination systems generally do not change in universities. The pandemic has taught us that some things in education, like the environment for teaching, learning and examinations, can vary. As educators, we have had to trust the students more. As a result of the pandemic, students may now find it easier to be examined remotely if the system is secure. There are also potential benefits for teaching and learning. For example, students attending a recorded on-line lecture and can revisit its content at any time. Of course, the danger is that number of students attending the lecture decreases considerably because it is on-line, which negates the benefit of learning as a social experience. In my opinion, students cannot learn in complete isolation—the whole point of learning is about understanding that other people matter, as do their opinions. Also, if you look at practical subjects like engineering, physics or biology, how can students learn these subjects remotely? Students need to conduct tests on materials, perform physical experiments or dissect specimens. So, information technology will change teaching and learning. But we have to be very careful that both teachers and students do not become lazy. Also, the social interaction part of learning is still a key skill—and we must not forget that.

Responding to the interdisciplinary trends in higher education

In terms of research and development, we can see more and more universities embarking on interdisciplinarity. What does this imply for universities and institutions which are still adhering to the single disciplinary approach?

That is a very good question. I think the dividing lines classifying academic subjects by their nature are very broad. As an example, the differential equations we use in physics are also needed in engineering. Linguistics and music are about perception and what we hear. The overlap is great, and our academic subjects are inevitably interdisciplinary. Of course, universities have to sub-divide subjects for the sake of practical management, but a lot of the sub-divisions are arbitrary. So, "interdisciplinarity" is about making it easy for departments in higher education institutions to collaborate and cooperate effectively, making university environment less parochial and trying to blur the boundaries between subjects and departments. These borders are artificial, and we should cross them.

> **"'Interdisciplinarity' is about making it easy for departments in higher education institutions to collaborate and cooperate, making university less parochial and trying to blur the boundaries between subjects and departments."**

One thing about interdisciplinary research and collaboration is that they can be very effective but also counterproductive. In terms of research funding, the world seems to be moving more towards funding bigger projects that enable and promote interdisciplinarity and collaboration between institutions. There is a perception, whether this is true or not, that a funding bid may be more likely to be supported if it involves universities from certain countries that are considered to be disadvantaged. Therefore, we have to be very mindful of the possible effects. Such politically-motivated collaborations may reduce standards, or, at least limit the contribution, and therefore impact, of individual universities in big collaborative projects. So, it is either collaboration or competition, and a little bit of overlap between the two.

I think COVID-19 and other unprecedented challenges the world is facing such as the energy crisis, global warming, an ageing population and reduced mobility during the pandemic, etc., have really taught us that things can change and that, actually, we can all work together to change for the better. It will be young people who solve these and future problems. Young people are our future, so we need to make it as easy as possible for them to do well and address these problems head-on. Higher education has a fundamental role to play in this, and we have to step-up collectively and start working together to make it happen.

We need more collaboration, partnerships and cross-departmental/institutional initiatives. How does this affect the various aspects of university management when it comes to resource governance and engagement?

This is a difficult and challenging topic. Resources for global universities are generally not increasing, and yet the pressures on global universities and the responsibilities they have to take-on are. We are living in a world with a cost-of-living and energy crisis with valuable resources being directed simply to enable people to survive. What implications does this have for resource budgets? Well, I think it is inevitable they are going to decrease. So, universities are being, and will continue to be, asked to do more with less. We have to be very innovative in how we address these issues. We need to develop an ecosystem that enables innovation.

Innovation can foster more cross-sector projects and forge closer partnerships between the university and industry to tackle major planetary issues. What are some challenges faced by higher education in this regard?

There are issues related to the academia–industry divide as well. In academia, there is the "technology push": universities will invest resources in pioneering research and inventions, which are clear academic drivers (academics like solving difficult problems). In industry, there is the "market pull": capitalists see opportunities to make money if they have certain devices, expertise and technologies, many of which are developed or provided by academics. Also, academia tends to be "people-based" since individuals are employed for their creativity, while industry tends to be "project-based" since companies have to make money and gravitate naturally to where the projects are. Here, we can see a divide between the two sectors. We need to develop effective ways of making sure that universities and industry collaborate. This can be seconding industry representatives into academia so that they can explore opportunities to place academics in industry, or by letting academics work in industry for a period of time to understand the real pressures there.

An East–West divide also seems to emerge, albeit generally, in higher education research. In the East, research development takes a "top-down" approach, so policies and agendas influence the kinds of research to be conducted and funded. In the West, research development is more likely to take a "bottom-up" approach, so new ideas and projects that emerge can be managed and integrated into the full research system. What implications does this divide have for researchers?

With the "top-down" approach, academics are more likely to achieve technologically relevant and driven research because they are told what they have to work on—but they are limited in their ability to do new things. This approach is more relevant to government or industrial research. With the "bottom-up" approach, universities employ an individual for their research expertise and intellect, and then see what happens. This often leads to new inventions and developments from fundamental scientific studies. This approach provides greater potential and capacity to do new things, but the number of innovations will be lower because the process is generally less directed.

> **"The nature of academia is driven by freedom of expression and the autonomy to get on with whatever one wants to, subject, of course, to available resource and legal limits."**

The nature of academia is driven by freedom of expression and the autonomy to get on with whatever one wants to, subject, of course, to available resource and legal limits. However, the line between "top-down" and "bottom-up" in research is blurred. For example, Germany employs a dual system in which research institutes are separate from universities. This is an interesting model. But there is also an argument that teaching and research go hand in hand—good teaching inspires good research, and vice versa.

Gearing up higher education for the future

Recent years have been particularly challenging to higher education due to the pandemic and the increasing expectations placed on university teaching and research. What is your advice for universities, so that they can better prepare for the future of higher education?

We need to learn to collaborate more effectively and to share data better. It is difficult to collaborate if institutions are guarded about academic data and if information flows only one way. We have to acknowledge that most of the work in universities is pre-competitive—we are not going to undermine a multimillion-dollar industry because two academics discuss a particular problem. Yet, with collaboration, we can reach a better solution by drawing on the wisdom of intelligent minds. We should somehow learn to shed our insecurities. We should be thinking differently about intellectual property and using it to bring people together, rather than to divide them. This is what the world is desperate for right now, and universities have a considerable role to play.

> **"Yet, with collaboration, we can reach a better solution by drawing on the wisdom of intelligent minds."**

Love for research and others drives sustainability research

> **The urbanisation of society is part of the development process ... A growing number of cities, however, are showing symptoms of the global environment and development crisis, ranging from air pollution to homeless street dwellers. (Agenda 21, WHO)**

Today, more than half of the world's population lives in urban areas, and this figure will increase to 68% by 2050—nearly 7 out of 10 people will live in cities. The resource consumption (e.g., land, water, fuels) and environmental damage associated with urbanisation are happening at a faster rate than ever before, compromising the lives of future generations. Therefore, for densely populated metropolises like Hong Kong, urban sustainability is particularly important. The harmonisation of three elements—economic growth, social inclusion and environmental protection—has attracted significant interest from scientists, engineers, and policymakers.

The Research Institute for Sustainable Urban Development (RISUD) was established in 2012 by PolyU President Prof. TENG Jin-Guang, then the Dean of the Faculty of Construction and Environment (FCE). RISUD aims to develop innovative solutions for sustainable high-density cities by capitalising on the living laboratory of Hong Kong. The Institute is now organised as a PAIR constituent research unit and is being led to new heights by Prof. LI Xiang-dong.

Riding on RISUD's decade of success

The new directorship marks the beginning of a new chapter for the research institute. "I took up the role of the RISUD Director in 2018. The Institute is now in its fourth phase of development", Prof. Li explained. "We aim to focus more on interdisciplinary collaboration to bring creative solutions to problems generated by high-density urban development. We will continue striving to support and nourish novel and impactful research in the area of sustainable urban development".

"Sustainable development" has become a buzzword and a development paradigm among governments, organisations, development planners, scholars and environmentalists. The concept can be traced back to the 1992 United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil—during which 179 heads of governments signed Agenda 21, declaring their determination to implement the concept of sustainability in national policies.

> **The establishment of RISUD represents the University's foresight of and agile response to the Nation's rapid economic development over the past decades.**

The establishment of RISUD represents the University's foresight of and agile response to the Nation's rapid economic development over the past decades. "The urbanisation as a result of economic growth in Mainland China is massive in scale. Many cities have been developed on the basis of Hong Kong's high-density urban development model and are characterised by a large number of high-rise residential and office buildings. This presents many unique challenges in construction and management, but also brings new opportunities to Hong Kong," said Prof. Li. In fact, the success and experience of RISUD since 2012 inspired President Teng to scale up PolyU's interdisciplinary research infrastructure and laid the foundation for the establishment of the central interdisciplinary research platform, PAIR, at the University.

Five-pronged strategy for sustainable urban development research

The Institute had five key research foci, namely, Urban Systems, Urban Infrastructure, Urban Environment, Green Buildings and Smart Cities from the beginning, several of which are relatively mature. "The research foci have distinct divisions, under which RISUD scholars are organised into smaller research groups to conduct studies. The research groups act as nodes, congregating researchers by common interest," Prof. Li explained. "We plan to set up a new Division of Carbon Neutrality. Some of our current divisions have been covered by other PAIR research institutes and centres. Therefore, RISUD will restructure our existing divisions and put resources into research on the topics, technologies and policies that are unique and not covered by other units."

> **At RISUD, members are well supported for engagement in interdisciplinary and cross-boundary collaboration.**

Currently, the Institute brings together over 130 members from 18 departments across four faculties and one school of PolyU. Members are organised into 36 research groups, each led by a senior researcher internationally recognised in that area. RISUD members have contributed to the Institute's massive success in the 2021/22 academic year, securing more than HK$15.9 million in large-scale grants for external projects, generating 84 papers and receiving 19 significant external awards.

At RISUD, members are well supported for engagement in interdisciplinary and cross-boundary collaboration. The Institute has launched various funding schemes in the last ten years. The Strategic Focus Area (SFA) Scheme (2016–2020) encouraged studies of strategic importance which aligned with the mission of RISUD, and the Emerging Frontier Area (EFA) Scheme (2018–2021) supported novel and multidisciplinary research in sustainable urban development with great potential for large external funding. "In 2021, we introduced the Joint Research Fund (JRF) and the Interdisciplinary Research Scheme (IRS), which specifically aim at supporting younger researchers with great potential for future academic development and collaboration among PolyU units, respectively," Prof. Li explained. The Institute has also set up an RISUD Visiting Fellowship Scheme and an International Visiting Scholar Programme, enabling members to engage in academic exchange with partner universities and international collaborators.

Promoting sustainable urban development via resilient marine infrastructure, tree monitoring and water purification

> **RISUD members are determined to draw on their expertise in multiple disciplines in large-scale research to bring forth new discoveries, technologies and solutions.**

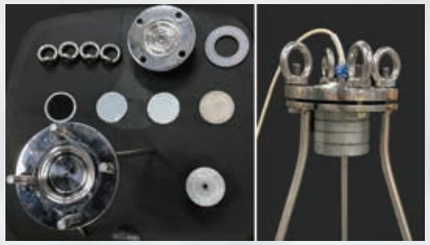
Urbanisation is associated with a myriad of challenges and issues related to humans and the environment. RISUD members are determined to draw on their expertise in multiple disciplines in large-scale research to bring forth new discoveries, technologies and solutions.

Marine infrastructure is faced with challenges of infrastructure resilience and a shortage of fresh water and river sand for producing concrete. The Institute came up with a way to increase the lifespan of marine infrastructure while reducing energy consumption and environmental pollution during the construction process. "President Teng, then the Project Coordinator, proposed replacing steel with fibre-reinforced polymer (FRP) as the reinforcing material. He initiated a project to experiment with this method, which directly used seawater and sea-sand to make concrete, known fittingly as seawater-sea-sand concrete (SSC)," Prof. Li said. Prof. Teng assumed his duty as PolyU President in July 2019. Prof. YU Tao, Associate Director of the Research Centre for Deep Space Explorations and Professor in the Department of Civil and Environmental Engineering, took on the project leadership role, while President Teng now serves as the Advisory Project Coordinator.

A number of tree collapse incidents have caused deaths and injuries in Hong Kong in recent years, and these incidents have increased calls for tree monitoring. RISUD member Sr. Prof. Charles WONG Man-sing, Associate Dean (Teaching) of FCE and Professor in the Department of Land Surveying and Geo-Informatics (LSGI), has joined hands with other institutions and government departments to develop and implement advanced technologies for the smart management of trees in Hong Kong. "The team assesses the risk of tree failure by monitoring trees' swaying

or tilting condition with sensors, thus improving tree risk management," said Prof Li. Sr. Prof. Wong has been working closely with the Hong Kong government on the strategic policies and framework for long-term urban tree management. The research findings have also been shared with the government in Singapore, which is exploring the use of sensing technologies for tree monitoring.

"In another project, our RISUD member Dr Yi JIANG, Assistant Professor in the Department of Civil and Environmental Engineering (CEE), leads a team to develop a new high-performance nano-enabled water filter which minimises leakage and health risks, thus advancing point-of-use (POU) water purification technologies," said Prof. Li. The research is a large interinstitutional project involving researchers from other local and overseas universities, i.e., The University of Hong Kong, City University of Hong Kong and the University of Missouri.



Unravelling the black box of air pollution for better health

Prof. Li's research on air quality management has attracted huge funding support from the public sector. A project he leads, "Unravelling the Black Box between Air Pollution and Public Health for Transformative Air Quality Management", won HK$44.5 million in funding in the Theme-based Research Scheme 2022/23 (Twelfth Round) of the Research Grants Council (RGC). The project aims to identify the toxic components and emissions sources that contribute to the acute toxicity of fine particulate matter ($PM_{2.5}$), which aggravates chronic obstructive pulmonary disease and ischemic heart disease.

"I am leading a multi-disciplinary team of over a dozen researchers from PolyU and other local and overseas universities, and several of them are advisors for the World Health Organization (WHO). The study will yield findings which can be used to make recommendations for effective, practical and cost-effective approaches to manage air quality and public health in Hong Kong and around the world," Prof. Li explained. "This may lead to a revision of the Air Quality Health Index algorithm and the associated health advice, and a review and updates of the Air Quality Objectives in Hong Kong. The findings will also be conveyed to other national and international bodies to influence future policy formulations for air quality in different parts of the world."

Bringing together outstanding scholars for research excellence, wider collaboration and a stronger culture of urban sustainability

> **"RISUD actively builds the research capacity of the PolyU community and stakeholders in sustainable urban development via professional exchange activities."**

RISUD actively builds the research capacity of the PolyU community and stakeholders in sustainable urban development via professional exchange activities. The Institute invites its members to present their projects and latest developments at research salons, organises distinguished lectures (funded by the Ove Arup Foundation) to raise public awareness of sustainability issues, and co-organises forums and functions. "RISUD is currently the host office of the University–Government–Industry Consortium (UGIC) for Sustainable Urban Development. In December 2022, we co-organised the "Construction R&D Forum – Bringing Applied R&D to a New Height" with the Development Bureau of the HKSAR. It brought together leaders from the government, universities and the construction industry to promote the importance of applied research and development in enhancing the industry's performance for future construction volume and challenges," said Prof. Li.

RISUD members' research impact has attracted distinguished recognition at the international level. "A total of 50 RISUD members are among the top 2% of scientists in the world, according to the 2022 list by Stanford University. Four members are on Clarivate Analytics' list of highly cited researchers for 2021 and 2022," shared Prof. Li, who received the Clair C. Patterson Award for

Outstanding Achievements in Environmental Geochemistry in recognition of his cutting-edge research in environmental geochemistry within the last decade. RISUD also shone in the 2022 Inventions Geneva Evaluation Days, earning one gold medal and two silver medals.

RISUD contributes specialist expertise and knowledge towards a sustainable future for Hong Kong. Several members hold public appointments. Dr George LIU, Associate Head (Partnership) and Professor in the Department of Land Surveying & Geo-Informatics (LSGI), serves as a Scientific Advisor of Hong Kong Observatory (HKO). He provides professional guidance to the HKO in maintaining an active link with the scientific community, pursuing long-term scientific and technical development strategies, as well as research studies and operational applications in specific scientific disciplines. Prof. WANG Tao, Associate Director of the University Research Facility in Chemical and Environmental Analysis and Chair Professor of Atmospheric Environment, is a member of the Air Science and Health Task Force of the HKSAR, contributing to the review of air quality standards and the assessment of health and economic impacts associated with air pollution. Sr. Prof. Charles WONG was appointed to the Urban Forestry Advisory Panel of the HKSAR, advising on urban forestry management strategies, applied research and development regimes, and positive capacity building initiatives for the arboriculture and horticulture industry.

Thirty-year research journey in environmental pollution

Prof. Li joined PolyU as an Assistant Professor in 1995, and has developed his academic career at the University until the present day. The various exposures Prof. Li had during his university education spawned his interest in environmental science and reinforced his determination to pursue a research career. "I earned my first degree in Earth Science and my master's degree in Geochemistry from Nanjing University. Several field trips during my research projects helped me to realise that mining and smelting operations create many environmental issues. This inspired my interest in environmental science," Prof. Li recalled. The young researcher then went abroad to the United Kingdom for his doctorate study. "I chose to join Prof. Iain THORNTON's research group on Environmental Geochemistry at Imperial College London in the late 1980s. That was the beginning of my fascinating research journey in the area of soil, sediment and air pollution over the last 30-plus years.

"Breakthrough research findings along the journey on several occasions have changed past knowledge and opened up a completely new academic field. This is the beauty of exploratory research. An academic job consists of research, teaching, and administrative tasks. I love the frontline research work with my team and am also extremely proud of the successes of our colleagues now," Prof. Li shared.

Love for research and love for others

> **"My own study and research always remind me to make more environmentally friendly decisions in my daily life."**

Over the years, Prof. Li is recognised for his innovative and dynamic work in environmental biogeochemistry, including research in the fields of regional contamination, urban air $PM_{2.5}$ pollution, and the origin and dissemination of antimicrobial resistance. Prof. Li is very glad to see the increasing environmental awareness in society over the last few decades. "My own study and research always remind me to make more environmentally friendly decisions in my daily life", he explained.

When asked for his advice for developing a successful career in academia, the senior researcher talked about the attitude a professional scientific researcher should have. "Asking important scientific questions in your field is important. You need to build your expertise on the chosen topic. Interdisciplinary research can be fun in many respects. Building a research network is very helpful for your career development."

However, it is more than that. A responsible scientist should also exhibit social virtue and care for others: "Building a truly sustainable society depends on the efforts of many individuals and organisations. Nurture your research team members (PhD students and postdoctoral fellows) and help them succeed! The training of future leaders in this field inspires me to contribute more in the future."

Upcycling waste for a carbon-neutral tomorrow

The concept of "carbon neutrality" became popular in the West in the 1990s. The term was selected as the "Word of the Year" for 2006 by the New Oxford American Dictionary. In December 2015, the Paris Agreement challenged nations to step up their efforts in reducing carbon emissions. The global agenda is to achieve carbon neutrality by 2050 or before, and limit the rise in global average temperature to 1.5–2 degrees Celsius.

Global climate change, increasingly frequent extreme weather and their associated environmental impacts have driven countries and cities to devise and implement "carbon neutral" policies. The Hong Kong Polytechnic University (PolyU) established the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE) in 2021 and has spared no effort in contributing to this ambitious goal.

Zero waste for zero emissions in a world of modern consumerism

> **"The Centre hopes to develop Hong Kong and the Greater Bay Area into models of resource engineering towards a circular economy.... It stresses the use of "waste" as resources to manufacture new products and deliver services. Thus, the whole economy becomes less resource intensive."**

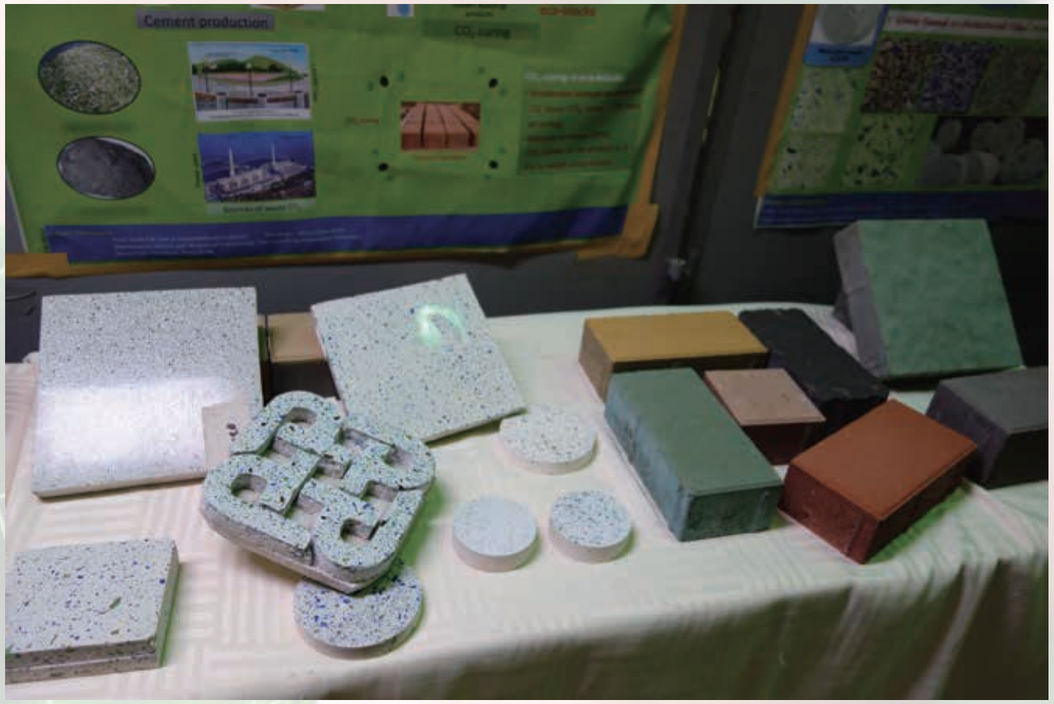
The current consumer economy has been enormously wasteful. We acquire resources, make products, use them, and then throw them away. "The Centre aims to be a global research centre in the area of solid waste recycling. We support the Hong Kong government's policy of achieving carbon neutrality by 2050. We are also committed to minimising the waste that goes to landfills," said Ir Prof. POON Chi Sun, Director of RCRE.

In fact, carbon neutrality is only one of the many environmental issues that RCRE has pledged to tackle. A sustainable society necessitates a shift in consumer behaviour. The Centre hopes to develop Hong Kong and the Greater Bay Area into models of resource engineering towards a circular economy. A circular economy moves away from wasteful consumerism. It stresses the use of "waste" as a resource to manufacture new products and deliver services; as a result, the whole economy becomes less resource intensive.

Novel ways of managing resources and waste

The realisation of a zero-carbon society and a green economy is one of the biggest problems on our planet, requiring combined efforts and wisdom from policymakers, scientists and community. The Centre's four main research directions provide multifaceted solutions to this complex problem. "Waste recycling and management has great relevance to policy-making and social implications. Our studies under *Policy and Society* focus on social impact assessment and policy evaluation, social entrepreneurship for waste recycling, and individual waste management behaviours. *Environmental and Economic Impact* includes life cycle analysis of organic and inorganic waste, so that it helps inform decisions about proper recycling technologies for the reutilisation and sustainable applications of various waste materials," Prof. Poon explained.

"Under *Waste Valorisation Technology*, we explore the reuse of waste materials like algae, food, yard waste, etc., and convert them into useful products like biochar and biofuel. Under *Recycling and Sustainable Construction*, we recycle the waste from construction and other materials and turn them into useful construction materials," Prof. Poon said. The Centre developed an Eco-Block technology which utilises these construction and demolition wastes together with recycled glass and incinerator ashes to make construction materials. The Centre also developed a carbonation technique that sequesters carbon dioxide and transfers concrete waste powder into high-value nano-construction materials.



Cutting-edge research platforms and facilities for innovative and advanced waste technologies

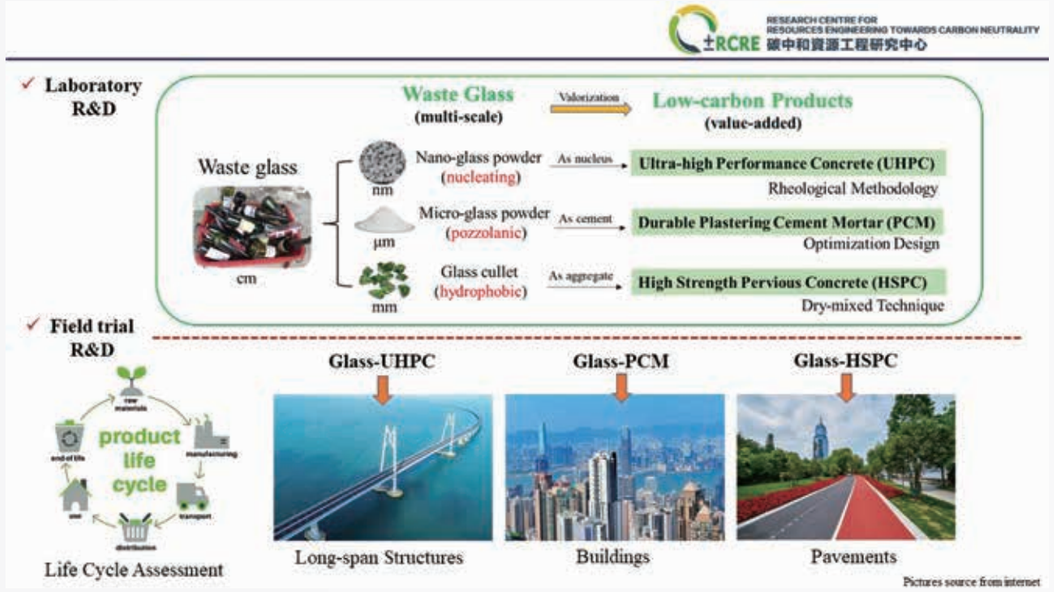
Cutting-edge research platforms and facilities for innovative and advanced waste technologies

The scientific study of waste and wide-ranging resources on our planet is highly complex and technical, requiring high-tech infrastructure. The six research facilities on the PolyU campus are where RCRE research outputs are incubated. These include the *Bioenergy Research Laboratory* dedicated to biofuel and non-catalytic research, the *Concrete Materials Laboratory* for the characterisation of cement-based and constructional materials, the *Road Research Laboratory* that supports the performance testing of road and pavement materials, the *Transport and Highway Engineering Laboratory* for conducting experiments on bituminous materials and transport-related measurement, the *Water and Waste Laboratory* for extensive characterisation of physical, chemical and biological samples, as well as the *Joint Laboratory on Solid Waste Science* in which research on safe waste treatment and resource utilisation technologies is conducted.

Waste management is an acute problem in Hong Kong. The three major landfills in the region are expected to be filled by 2030, and their capacity is decreasing fast. "In the 2021/22 year, our Centre obtained a total grant of over HK$16 million from external bodies, to conduct fundamental and impactful research on woody waste, waste glass and incineration ashes," Prof. Poon said.

Among the four externally funded projects are two large projects funded by the HKSAR Government's Green Tech Fund. In *Biochar-enhanced Construction Materials for Sustainable Waste Management and Decarbonisation*, Prof. Daniel TSANG, Professor in the Department of Civil and Environmental Engineering, leads his team in developing innovative designs and science-informed manufacturing technologies for biochar-enhanced construction materials. This work has given rise to pioneering products, including a biochar partition block and biochar porous paver.

"I am leading a team on the project *Low-carbon Transformation of Construction Materials Using Waste Glass*, which just started in January 2023. We will use glass powder and cullet derived from waste glass bottles to produce high-performance construction materials," Prof. Poon explained. "Glass waste is a major component of solid waste in Hong Kong,



and its recovery rate has consistently been under 20%. On the other hand, in the construction industry, concrete production accounts for about 8% of global anthropogenic carbon dioxide emissions." The project is expected to reduce the production of glass-based and embodied-carbon concrete materials, thus reducing carbon emission that results from glass waste and concrete production.

Ambitious efforts by high-calibre researchers and engaging the wider community for a greener tomorrow

> **"The Centre has 27 high-calibre researchers from different departments at PolyU. Seven RCRE scholars were named among the top 2% of the most-cited scientists worldwide in 2022, according to a list by Stanford University."**

The funding success marks RCRE's remarkable research development since its inception. The Centre also has published 19 articles in high-ranking scientific journals and filed one patent for the development of low-carbon fibre-reinforced cement using cement clinker and flue gas in a cement plant.

The success would not be possible without the efforts of RCRE scholars. "Currently, the Centre has 27 high-calibre researchers from different departments at PolyU. Seven RCRE scholars were named among the top 2% of the most-cited scientists worldwide in 2022, according to a list by Stanford University," said Prof. Poon, who ranks third globally in the field of Building and Construction. Another RCRE member, Prof. Daniel Tsang, is the only RCRE scholar and one of the twelve PolyU academics recognised on the 2022 Clarivate Analytics list of highly cited researchers.

Encouraging new solutions and amplifying research impact

RCRE scholars are encouraged and well supported to engage in interdisciplinary projects in line with the Centre's research direction. The Centre's internal seed fund programme 2021/22 has received a very positive response and a high number of excellent proposals. Sixteen proposals among the twenty submissions have been funded. "The seed projects are led by PolyU academics from various schools and departments. For example, our members from the School of Fashion and Textiles (SFT), Associate Professors Dr FEI Bin and Dr FAN Di, are studying the upcycling of home textile wastes into organic carbon electrodes for rechargeable batteries, and the factors motivating carbon neutrality goal settings in local manufacturers, respectively. Dr WONG Ka Hing, Director of the Research Institute for Future Food (RiFood) and Associate Professor in the Department of Applied Biology and Chemical Technology (ABCT), is researching carbon-neutral materials using major types of commercial and industrial food waste in Hong Kong. Dr REN Jingzheng, Associate Professor in the Department of Industrial and Systems Engineering (ISE), is investigating urban waste biorefinery for a circular economy and industrial symbiosis," Prof Poon explained.

> **"The Centre has also been building links and partnerships with major stakeholders in government and commerce to help amplify research impact."**

"The first internally funded project started in February 2022, and we look forward to seeing further progress in the future," said Prof. Poon. The RCRE seed fund helps PolyU researchers try out new solutions, technologies and research, paving the way for seeking large external funding from the government and industry for knowledge and technology transfer. The Centre has also been building links and partnerships with major stakeholders in government and commerce to help amplify research impact. "We are now in discussions with various government departments involved in Hong Kong's infrastructural development on collaborative trial projects on the use of low-carbon construction materials and methods," Prof. Poon added.

Thirty-year journey at PolyU

The year 2023 is Prof. Poon's thirtieth year at PolyU, since he joined as a lecturer in 1992. He earned his doctorate degree in public health (environmental) engineering from Imperial College London in 1985 and began his academic journey the same year as a Research Fellow at Oxford University. Prof. Poon joined The Hong Kong Polytechnic (the predecessor of PolyU) and has been developing his professional and academic career until the present time.

"I am greatly interested in the work that I am doing—turning waste into resources. This not only helps develop my research career but also helps protect the environment by minimising carbon emissions and sequestering carbon dioxide," Prof. Poon said. The ambitious scientist has published more than 500 papers including over 400 peer-reviewed research papers in international journals, filed 10 patents, authored six books, and contributed to a wide variety of international conference proceedings, journals, as well as professional and governmental bodies.

A brighter future for environmental research

> **"I really hope young researchers can dwell in, on one hand, something that is interesting to them, and on the other hand apply their research results to contribute to the well-being of society."**

The scientist is optimistic and confident about the future of research in sustainable construction and waste management. "The growing awareness of climate change in recent years has greatly promoted interest in carbon neutrality. We are seeing more research funding opportunities from the public and private sectors. I really hope young researchers can dwell in, on one hand, something that is interesting to them, and on the other hand apply their research results to contribute to the well-being of society."

The DoPAIR and RI Directors recognised as Fellows of the Hong Kong Academy of Engineering Sciences

Prof. CHEN Qingyan, Director of the PolyU Academy for Interdisciplinary Research (PAIR), Prof. CAO Jiannong, Director of the Research Institute for Artificial Intelligence of Things (RIAIoT), and Prof. LI Xiangdong, Director of the Research Institute for Sustainable Urban Development (RISUD), were elected as 2022 Fellows of the Hong Kong Academy of Engineering Sciences (HKAES). An induction ceremony and dinner were held on 6 February 2023 at Hotel ICON.

HKAES is a professional engineering organisation in Hong Kong that is dedicated to serving Hong Kong, Mainland China and the region with top-quality engineering expertise. Fellows come from various engineering disciplines and are recognised leaders in the profession with distinguished achievements in engineering sciences or applications. Only eight Fellows may be elected annually by their peers for personal achievements of exceptional merit and distinction.

Prof. YU Changyuan elected Optica Fellow 2023

Prof. YU Changyuan, Management Committee Member of the Photonics Research Institute (PRI), has been elected to the 2023 Class of Optica Fellows in recognition of his significant contribution to signal processing in optical fibre communication and sensing systems, and his active service to the optics community.

Optica elected 109 members from 24 countries to the society's 2023 Fellow Class. Optica fellows are members who have served with distinction in the advancement of optics and photonics. The overall number of fellows is limited by the society's bylaws to no more than 10% of the total membership, and the number of fellows elected each year is limited to approximately 0.5% of the current membership.

RILS scholars clinch "Research Team of the Year" at 2022 RICS Awards Hong Kong

A research team led by Prof. Geoffrey SHEN Qiping, Member of the Research Institute for Land and Space (RILS), won the "Research Team of the Year" award at the 2022 Royal Institution of Chartered Surveyors (RICS) Hong Kong Awards.

Since 2019, the research team has been working closely with the Qianhai Authority to enhance collaboration between the construction sectors in Shenzhen and Hong Kong, and to put forward solutions to problems encountered by the two regions' construction industries in cross-border cooperation. The team successfully drafted two sets of measures: "Administrative Measures for the Registration of Hong Kong Construction Organisations in the Qianhai Shenzhen–Hong Kong Modern Service Industry Cooperation Zone" and "Administrative Measures for the Registration of Hong Kong Construction Professionals in the Qianhai Shenzhen–Hong Kong Modern Service Industry Cooperation Zone".

These measures have been adopted by the Qianhai Authority for enforcement, and their implementation has helped to dismantle barriers to qualification recognition in the Shenzhen and Hong Kong construction sectors. The research team's promotion of collaboration in the construction industry in the GBA has been recognised highly by the Society. The prestigious award not only represents the team's outstanding achievements in the built environment, but also motivates the team to continue contributing to infrastructural development in the Greater Bay Area.

RISE member wins Best Paper Award at 22nd International Conference on Construction Applications of VR

A paper co-authored by Dr LEE Minhyun, Member of the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), won the Best Paper Award for Environmental Sustainability at the 22nd International Conference on Construction Applications of Virtual Reality.

Dr Lee's paper, "An Integrated Design of Energy and Indoor Environmental Quality Monitoring System for Effective Building Performance Management", proposes the integrated design of a monitoring system embedded with the internet of things (IoT) for efficient building energy and indoor environmental quality (IEQ) management. The system's hardware comprises sensors, a wireless microcontroller and a power management unit to acquire, process, and telemeter energy and IEQ data. Meanwhile, the system's embedded software and web-based information provision unit handle real-time data analysis, transmission and visualisation.

The system will inform end users about energy consumption patterns, thus providing a promising solution for effective building energy and environmental management.

The Director of RISA awarded 1st BOCHK Science and Technology Innovation Prize in "Life and Health" field

Prof. ZHENG Yongping, Director of the Research Institute for Smart Ageing (RISA), has been awarded the inaugural BOCHK Science and Technology Innovation Prize in the field of "Life and Health".

Prof. Zheng has obtained more than 50 patents, and he was ranked by Stanford University in the top 2% of the most-cited scientists worldwide in 2021 and 2022. His main research areas are biomedical ultrasound instrumentation, soft tissue elasticity measurement and imaging, 3D ultrasound imaging and smart aging technologies.

The research team led by Prof. Zheng has developed a 3D ultrasound imaging system: Scolioscan, which can provide accurate, safe and cost-effective radiation-free scoliosis assessment. The invention has been applied to clinical assessment in many countries to facilitate early diagnosis and treatment of scoliosis, and to control the condition using non-surgical intervention.

Prof. Benny CHEUNG appointed as President of Asian Society for Precision Engineering and Nanotechnology

Prof. Benny CHEUNG, Director of the State Key Laboratory of Ultra-precision Machining Technology and Associate Director of the Research Centre for SHARP Vision (RCSV), has recently been appointed as President of the Asian Society for Precision Engineering and Nanotechnology (ASPEN), a union of academic societies based in Asia that promotes collaboration among members and cultivation of young researchers.

Prof. Cheung is a chartered engineer (UK) and a fellow of the International Academy of Engineering and Technology (AET). In 2022, he was named by Stanford University in the top 2% of the world's scientists in the field of Industrial Engineering and Automation. Prof. Cheung and his research team developed the Nano Multi-rings Defocus Incorporated Lens for controlling myopia progression. The lens incorporates two PolyU-patented technologies: the Defocusing Incorporated Soft Contact Lens (DISC) Technology which can reduce myopia progression by 60% in children, and the Ultra-precision Nano Multi-rings Machining Technology (UPMT) which improves comfort in lens wearers. The lens will be fine-tuned and rolled out soon in Hong Kong and inland China by a PolyU-supported start-up, Vision Science and Technology Company Limited.

RCSV Management Committee Member conferred American Mathematical Society Fellowship 2023

Prof. CHEN Xiaojun, Management Committee Member of the Research Centre for SHARP Vision (RCSV), was elected to the 2023 Class of Fellows of the American Mathematical Society (AMS) in recognition of her contributions to mathematical optimisation, stochastic variational inequalities and the analysis of non-differentiable functions.

Prof. Chen has a distinguished track record in academic research and research leadership. She has published over 90 research papers in the top journals of applied mathematics. Prof. Chen has received over 20 grants from the Australian Research Council, the Japan Society for the Promotion of Sciences, and the Hong Kong UGC Research Grants Council (RGC). She was awarded a grant of over HK$3M from the RGC Collaborative Research Fund (CRF) in 2022.

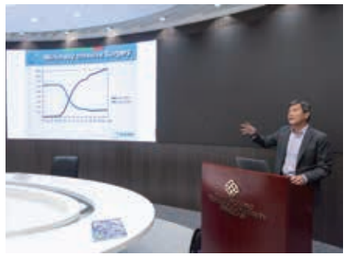
Prof. Chen has made a significant contribution to the promotion and maintenance of high professional standards in mathematical research at PolyU. She serves as an Area Editor and an Associate Editor for seven international journals including the SIAM (Society for Industrial & Applied Mathematics) Journal on Numerical Analysis and the SIAM Journal on Optimization.

Prof. Dan TSANG named to Royal Society of Chemistry and HKSAR Advisory Council on the Environment

Prof. Dan TSANG, Core Member of the Research Institute for Future Food (RiFood), Member of the Research Institute for Land and Space (RILS), Member of the Research Institute for Sustainable Urban Development (RISUD) and Management Committee Member of the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE), has been elected as a Fellow of the Royal Society of Chemistry (RSC). The Society is a professional body based in the United Kingdom that connects over 54,000 members across the world. Fellows of RSC must have held positions of influence for more than five years and have made demonstrable contributions to chemical sciences and their advancement.

Prof. Tsang has also been appointed as a Member of the Advisory Council on the Environment (ACE) for a two-year period from 1 January 2023 to 31 December 2024 by the Hong Kong Special Administrative Region government. The ACE is an advisory body to the government on policies and measures related to pollution control and environmental protection.

The 1st PAIR Public Seminar successfully held on 10 January



Dr WANG Yulun, Fellow at Teladoc Health and Co-founder and Chairman of World Telehealth Initiative and Maxcess Health, delivered a PAIR Public Lecture titled "An Entrepreneur's Perspective on Surgical Robotics and Telemedicine, and their Convergence" in hybrid mode on 10 January 2023.

The seminar attracted over 120 participants from more than 25 countries and regions, including Australia, Canada, China, Hong Kong, India, Italy, Japan, the Netherlands, the Philippines, South Korea, Taiwan, the United Kingdom and the United States of America. The participants were from diverse backgrounds and sectors: academia, science and engineering, research and development, the medical and healthcare industry, and others.

Call for young talents to be prospective Research Assistant Professors at PAIR

The PAIR Young Fellowship scheme was established under the University's Strategic Hiring Scheme to attract outstanding PhD graduates from top academic institutions worldwide to join PAIR as Research Assistant Professors and conduct interdisciplinary research.

A Young Fellow is expected to pivot away from his/her PhD research discipline, work closely with a leading scholar in a new discipline, and conduct interdisciplinary research in one or more Research Institutes/Research Centres at PAIR.

A competitive remuneration package and an attractive start-up grant will be provided to Young Fellows. Those who have demonstrated excellent performance during the three-year fellowship period will be considered for professorial-track academic staff positions at PolyU.

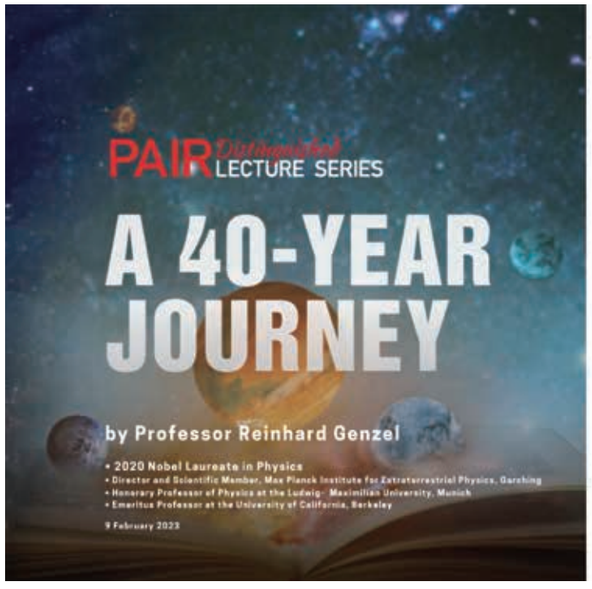
Rounds of application are offered throughout the year. For more information, please stay tuned for the latest announcements from PAIR's website at https://www.polyu.edu.hk/pair/research/pair-young-fellowship-scheme/ and visit PolyU Human Resources Office website at https://www.polyu.edu.hk/hro/careers/globalsearch/pair_yf_raps/.

Nobel Laureate Prof. Reinhard GENZEL delivers the 5th PAIR Distinguished Lecture

A PAIR Distinguished Lecture was delivered by Nobel Laureate Prof. Reinhard GENZEL, Director and Scientific Member of the Max Planck Institute for Extraterrestrial Physics, Garching, Germany, on 8 February 2023. The webinar attracted over 500 participants from more than 60 countries and regions, including Australia, Canada, China, France, Germany, Greece, Hong Kong, India, Italy, Japan, Macau, the Netherlands, Russia, Singapore, Spain, Switzerland, the United Kingdom and the United States. It was also broadcasted live on multiple social media platforms, including Bilibili and Weibo, and viewed by an online audience of over 18,000 people in total.

The webinar was kicked off by Prof. CHEN Qingyan, Director of PolyU Academy for Interdisciplinary Research (PAIR) and Chair Professor of Building Thermal Science in the Department of Building Environment and Energy Engineering at PolyU; followed by a welcome speech by Prof. TENG Jin-Guang, President of PolyU; and a speaker introduction by Prof. Christopher CHAO, Vice President (Research and Innovation) and Chair Professor of Thermal and Environmental Engineering at PolyU.

Prof. Genzel shared his 40-year journey in testing the massive black hole paradigm in the galactic centre. He traced the development of the relevant research by various scientists, from Albert Einstein to Stephen Hawking. He also described the precise, long-term studies in which he and his colleagues used the motions of gas and stars as test particles for space-time, demonstrating the existence of an object with a mass four million times that of the sun.
A question-and-answer session moderated by Prof. Chao and Prof. Chen followed. The audience engaged in a fruitful exchange with Prof. Genzel.



First PAIR Conference coming in May!

PAIR is organising its first Conference under the theme of "Research Excellence for Societal Impacts", to be held in hybrid mode (online and on the PolyU campus), on 8–11 May 2023 (Monday–Thursday).

The four-day PAIR Conference is the first and largest event in Hong Kong higher education dedicated to professional knowledge exchange on interdisciplinary research and development. It will provide a platform for closer collaboration among stakeholders from various fields in industry, academia, and governments around the world who are building capacities in science, technology, innovation and research. Approximately 600 guests from various countries, sectors and backgrounds will join the Conference in person or online.

Plenary Session by Prof. YAN Nieng, Founding President of the Shenzhen Medical Academy of Research and Translation

For Conference details, please visit https://www.polyu.edu.hk/pairconference2023/

Conference highlights

- **Plenary Session by Prof. YAN Nieng,** Founding President of the Shenzhen Medical Academy of Research and Translation of the Shenzhen Medical Academy of Research and Translation
- **Keynote Sessions, Technical Sessions and Panel Discussion Sessions** delivered by a total of more than 180 speakers
- **Paper and Poster Presentation** covering Smart and Sustainable Cities; Good Health and Well-being; and Advanced Technologies and Manufacturing
- **Showcase** of state-of-the-art research and technologies by the 11 Research Institutes and 5 Research Centres of PAIR
- **Laboratory Visits** covering different laboratories on the PolyU campus

Keynote Sessions

Technical Sessions

Poster Presentation

Laboratory Visits

PAIR projects showcase in InnoTech Expo 2022

PAIR members participated in the InnoTech Expo organised by Our Hong Kong Foundation, 12–22 December 2022 at the Hong Kong Convention and Exhibition Centre. The organiser selected 25 outstanding and representative scientific research projects for showcasing at the expo. PAIR is very proud that a number of our excellent research projects were chosen for exhibition under the themes of "medical and health sciences", "communications and automation", and "environmental and food science".

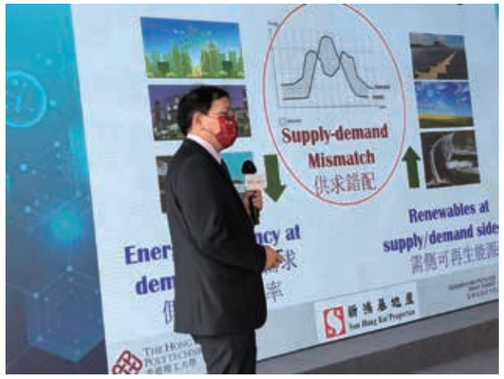
The selected projects include:

- Advanced Space Instruments and Remote Sensing Technologies—"Surface Sampling and Packing System", "Mars Landing Surveillance Camera" ("Mars Camera") and "Innovative Topographic and Geomorphological Characterisation and Analysis Technique" developed by the Research Centre for Deep Space Exploration (RCDSE) for the Nation's Lunar and Mars exploration missions;
- "Smart Monitoring System for Urban Tree Management" by the Research Institute for Land and Space (RILS);
- "Comprehensive Spatial Analysis and Onset Risk Prediction Platform for the COVID-19 Pandemic in Hong Kong" and "Three-dimensional (3D) Mobile Mapping System" by the Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI); and
- "3D Ultrasound Imaging System for Radiation-free Scoliosis Assessment" by the Research Institute for Smart Ageing (RISA).

SHKP and PolyU sign MoUs on Building Innovation & Technology Research Projects and Scholarship Programme

On 18 November 2022, Sun Hung Kai Properties Limited (SHKP) and PolyU signed memoranda of understanding for collaboration on research projects on green application, green building materials, and green construction processes to support Hong Kong's development into a smart city. Prof. WANG Shengwei, Director of the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), and two other professors will lead three collaborative projects, each worth HK$5 million.

Among them, the green application project "Full Life Cycle Optimisation of Green Smart Building Energy System", led by Prof. Wang, will be conducted at SHKP's integrated complex atop the High-Speed Rail West Kowloon Station. This project will enable real-time, flexible and optimised energy control at the site.



PolyU and Wuxi government to set up pioneering innovation and technology research institute

PolyU signed a cooperation agreement with the Wuxi city government in late 2022 to jointly establish the PolyU–Wuxi Technology and Innovation Research Institute, marking a pioneering move among Hong Kong's tertiary institutions to set up a scientific research institute in Wuxi and participate in the Yangtze River Delta's innovation and technology drive.

The five-year cooperation agreement was signed by Prof. Christopher CHAO, Vice President (Research and Innovation) of PolyU, and Mr ZHANG Jinwei, Head of Xinwu district, Wuxi, in a video conference. The agreement was witnessed by Dr LAM Tai-fai, Council Chairman of PolyU; Prof. Jin-Guang TENG, President of PolyU; Mr DU Xiaogang, Communist Party Secretary of Wuxi; Mr ZHAO Jianjun, Deputy Party Secretary and Mayor of Wuxi; and other leaders of PolyU and Wuxi authorities.

Under the agreement, which came into effect in January 2023, the Faculty of Engineering of PolyU and Wuxi National Hi-Tech District (WND) will collaborate to set up the Institute in the Wuxi Airport Economic Development Zone, and the Wuxi municipal government will provide the required facilities, infrastructure and funding over the five years to support the Institute's development. The Institute will include a teaching and research facility for the engineering doctorate programme, an advanced research platform for cutting-edge technologies, and an innovation hub for translational research and incubation of start-ups.

At the ceremony, Prof. H.C. MAN, Director of the Research Institute for Advanced Manufacturing (RIAM) and Dean of the Faculty of Engineering, explained the new Institute's significance as a world-class advanced research and innovation platform that will nurture innovation and technology talents and foster emerging industries. RIAM will actively collaborate with the Institute for research in the areas of aviation and aerospace, advanced manufacturing, new materials, artificial intelligence, new energy, biomedical technology and communication networks.