

## Research Assessment Exercise 2020

### Impact Overview Statement

**University: The Chinese University of Hong Kong**

**Unit of Assessment (UoA): 11 Mathematics and Statistics**

**Total number of eligible staff of the Faculty in the UoA: 32**

**(1) Context** – context for the individual case study (ies)

This UoA comprises the Department of Mathematics and the Department of Statistics at CUHK. The UoA has diverse and interdisciplinary research interests. Its faculty members are devoted to conducting the state-of-the-art research and their works are regularly published in world's leading journals. The UoA's goal is to become a world-class unit, providing the highest-quality education and leading-edge research. Several research areas, including Statistical Finance, Risk Management Science, Applied Differential Geometry, Financial Mathematics, are influential, which are exemplified by our three submitted impact cases. The state-of-the-art research in this UoA delivers impacts extending to the **economy, industrial environment, medical diagnosis and society**. It demonstrates the UoA's capability in direct collaboration with end-users and developing practical solutions to real-life problems. The non-academic beneficiaries of the UoA's research are drawn from diverse spectrum. They include **financial management companies, 3D imaging companies and medical diagnostic tool developers** through the adoption of UoA's novel statistical models and algorithms to develop new and revolutionizing products and services. The other non-academic beneficiaries are the **general public** through various outreach activities, STEM education as well as launching freeware developed from innovative research.

**(2) Approach to impact** – the unit's approach to impact during the assessment period for impact

The UoA encourages building networks with non-academic beneficiaries, so as to develop a deeper understanding of real-world issues and problems for multi-dimensional impacts.

**i. Forging and strengthening industrial collaboration:** The linkage with industrial partners is considered to be of strategical importance. **(a)** The UoA values the significance of knowledge transfer and thus actively encourages colleagues to **invite product developers from industries of various sectors to visit the UoA** regularly to explore real-world problems from industry. Colleagues also actively participate in industrial professional conferences as keynote speakers. Since 1984, the UoA has established the "Statistical Consulting Unit" and reformed it to become the "**Statistics Impact Case Centre**" in 2019. The centre has been led by faculty members, in which PhD students have been assigned to provide professional consultation to other units' users and the general public, exemplifying knowledge transfer by applying statistics to real-life problems. **(b)** To encourage the engagement of industrial collaborations, UoA has set up funding support in various areas. **Research fund** has been provided to faculty members once every 2 years as the **seed money for industrial collaborations**. Additional funding supports are provided to further nurture more impact case(s). **(c)** The state-of-the-art research from UoA has drawn attention from industrial insiders, which led to collaborations. **Student internships** have been offered by a diverse range of industrial partners including HSBC, Bank of China, BNP Paribas Investment Partners Asia, etc.

**ii. Support for public engagement:** **(a)** UoA encourages faculty members to serve the community with their expertise, which can influence policymaking. Examples include the consultancy project member of the Hong Kong Monetary Authority, the member of the Hong Kong Deposit Protection Board, etc. UoA proactively places students for internship in public sectors, for instance, the **Hong Kong Observatory, Hong Kong Exchanges and Clearing Ltd., HKSAR Census and Statistics Department**, etc. **(b)** Colleagues are encouraged to launch online open-access tools developed based on their research projects. This helps practitioners and public understand and appreciate research works from the UoA, and assists the Unit to explore real-world applications. **(c) Diverse outreach activities** have been hosted by the UoA or in collaboration with partner organizations. UoA has co-organized with the **Hong Kong Science Museum** for the *SciFest* since 2014. To promote STEM education, UoA has organized the programme of **Science Academy for Young Talent** (since 2011) and **Lau Oi Wah Memorial Science Lecture Series** (since 2014) at Faculty level. With the generous support of industrial partners, UoA has organized the [Enrichment Programme for Young](#)

**Mathematics Talents (EPYMT)** since 2002, which provides enrichment mathematics courses for talented secondary school students. Since 2004, the UoA has co-organized with Hang Lung Properties Limited for **Hang Lung Mathematics Awards**, which is a biennial mathematics research competition for local secondary school students, aiming to encourage them to realize their creative potential in mathematics/sciences and stimulate their passion for intellectual discovery. Furthermore, 3 faculty members from Statistics department have been actively involved in the **Hong Kong's first trading contest – CASH Inter-University Algo Trading Contest** (since 2016) as judges and consultants, aiming to arouse public awareness of knowledge transfer to real-life applications.

**iii. Impact development:** (a) UoA members are encouraged to draw upon services provided by **The Office of Research and Knowledge Transfer Services** at University level to establish industrial links and knowledge transfer. (b) UoA encourages students to receive **entrepreneurship training** apart from their major subjects. CUHK Entrepreneurship and Innovation programme is an interdisciplinary programme founded in 2017, which provides comprehensive entrepreneurship trainings. 6 undergraduates in this UoA have enrolled in this programme since 2017.

**(3) Strategy and plans** – strategy and plans for supporting impact

The following strategies and plans have been adopted by UoA for supporting impact:

**i. *Improving and striving for new industrial collaborations with the establishment of new labs and centre.*** (a) “**Center for Mathematical Artificial Intelligence**” and “**Statistics Impact Case Centre**” have been established to assist faculty members to develop potential impact cases and stimulate all related activities. (b) Statistics department has recently initiated industrial collaboration with Didichuxing ([www.didiglobal.com](http://www.didiglobal.com)). The goal is to establish the “CUHK-Didi Joint Laboratory” which offers a platform for scientists to access relevant real-life big data set and artificial intelligence (A.I.) technologies of the company for statistical research development. (c) Mathematics department has established the “Center for Mathematical Artificial Intelligence” with the support of industrial partners (e.g. Huawei). The goal is to provide a platform for scientists to carry out rigorous analysis and develop impactful A.I. technologies through advanced mathematics, which can be generally applied to solve real-world problems.

**ii. *Fostering public engagement.*** UoA recognizes the significance of the networking among the general public, industries and end-users. UoA will continue to organize public talks (e.g. HK SciFest 2019), international conferences (e.g. 2019 NBER-NSF Time Series conference), research collaborations with public sectors and industries, and seek for more student internship opportunities.

**iii. *UoA's support for boosting impact development.*** UoA plans to hire 3-4 staff to implement the developed algorithms and to monitor/maintain the online platform, so that they are more accessible to larger target audiences. UoA's members working on impact case studies will be given one course teaching relief as an incentive to encourage impact development. UoA will also provide funding support for mutual visits from and to industrial partners to encourage research collaborations.

**(4) Relationship to case studies** – the relationship between the unit's approach to impact and the submitted case studies

The three submitted impact cases illustrate the extensive range of UoA's research and staff agility. All cases arose from the successful collaborative research projects with sustainable impacts. The innovative methods from Chan's and Wong's impact cases, as well as the novel algorithms from Lui's impact case, have been implemented and adopted by numerous international financial companies and a US-based 3D imaging company respectively. Impacts for improving the industrial operation accuracy and resolving technical constraints are exemplified by the 3 submitted impact cases. Student internships have been offered by industrial partners. Cases from Lui and Wong also deliver impacts with public engagement by launching their software tools online for free public access.