Research Assessment Exercise 2020
Impact Overview Statement

University: The Chinese University of Hong Kong
Unit of Assessment (UoA): 14
Total number of eligible staff of the university in the UoA: 27

(1) Context - context for the individual case study(ies)

UoA 14 consists of faculty members from Mechanical & Automation Engineering Department, Systems Engineering and Engineering Management Department as well as a few from Biomedical Engineering Department. The research covers a wide range of topics such as Robotics, Energy, Systems and Control, Financial Engineering, Logistics and Supply Chain Management, Biomedical Engineering, etc. The research fully aligns with the HKSAR's direction to develop artificial intelligence and robotics technologies, as well as the vision of putting HK on the map of Smart City and Industry 4.0 / Smart Manufacturing.

The UoA encourages knowledge transfer and the collaborations with other institutes and industries to develop systems or products that have been transformed to real world applications and products. It can be explained by the chosen impact cases which are evolved from the research in Robotics, one of the core excellence in this UoA. "Robotic algorithm and technology development for surgical and logistics applications" (RATD) is related to visual-based robotic servo algorithms for logistics and surgical applications; flexible robotic technology for early stage lung cancer diagnostics. "Motion Capture and Assistive Systems" (MCAS) is related to motion capture and assistive devices/systems. Other high impact of our research includes numerous awards from professional associations, universities, governments and companies: the large number of paper citations by peers; 18 patents for technology transfer and media reports on TV and in newspapers.

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

The UoA encourages impact development by emphasizing in staff appraisals the importance of visibility, and collaboration with the industry. Success in industry funding is a key performance indicator. For example, the UoA secured 43 Innovation and Technology Fund projects. Many of these had close collaboration with companies and received cash sponsorship from companies. These projects received $85M approximately. For instance, with the generous donation from T Stone Group Limited, CUHK T Stone Robotics Institute (CURI) was established in 2016. In 2018, Prof. Y.H. Liu received an RGC theme-based research project titled "Image-guided Automatic Robotic Surgery" with the approved funding of $47.341M.

The underlying long term strategy to attain impact is to recruit "the best of the best" by adopting a rigorous search and recruitment process in the recruitment of new academic staff, and apply a rigorous review and assessment before substantiating the academic staff (after a maximum of 6 years of contract service) for permanent employment (tenure).

In the recruitment search, we target strategic areas for priority in recruitment. Robotics, industrial automation and energy were some of the key research areas that we have strengthened in recent years. Our research culture places great emphasis on collegial collaborations in a free academic environment where individual faculty members select their own research agenda to explore new and emerging technologies. We facilitate knowledge transfer by having policies for outside practice which gives academic staff the freedom to spend 20% of their time on "outside practice" activities such as industry consultancies.

(3) Strategy and plans - strategy and plans for supporting impact

The strategic research areas of the Faculty of Engineering were aligned with the University strategic areas of Translational Biomedicine, Information and Automation Technology, and Environment and Sustainability, which are also relevant to UoA 14 including (i) automation technology (including robotics, intelligent systems and control); (ii) biomedical engineering (including medical devices and tissue engineering); (iii) energy efficiency (including building and environmental technologies); (iv) materials, MEMS and nanotechnology; (v) operations research and optimization; (vi) FinTech and financial engineering; (vii) artificial intelligence (including image processing and data analytics).

The strategic directions of the Faculty guide the recruitment strategy for recruiting new academic staff. The faculty policy is to give priority to hiring in the strategic areas defined by the faculty and not necessarily replace areas where staff were retiring from. The University provided central matching funds to hire new faculty related to the strategic areas of the university. To encourage research aligned with the faculty's or university's strategic areas, the University also provides additional resources (grants, postdoctoral researchers and equipment matching funds) from the University's strategic development fund and the faculty's strategic development fund for new projects aligned to the strategic areas.

To strengthen visibility and increase social and economic impact, staff members are encouraged to actively participate in technology exhibitions and both CINTEC and ORKTS help academic staff to participate in exhibitions which can attract industry interest. An impact coordinator in the UoA organizes the impact-oriented activities and further strengthen connections between academia and industry. Academic staff have the incentive beneficial to the annual appraisal and the substantiation review of securing external funding sources, including collaborations with industry.

The UoA has partnered with the Hong Kong Applied Science and Technology Research Institute (ASTRI) to establish joint research laboratory to drive the research and more importantly its applications to intelligent manufacturing.

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

The two case studies chosen by the Department of Mechanical and Automation Engineering are the outstanding examples showcasing the impacts of academic researches to relevant industries and to the society. Both cases have a close collaboration with the industry. The knowledge and products are directly used by the industry. For example, in MCAS, a spinoff company was created and the technology was used worldwide. The technology created by RATD are being licensed by companies. The studies are listed in the matrix of the table below where the significant impact is denoted by a bullet, and other routes by an open circle.

Route to Impact	Case Study: Motion Capture and Assistive Systems	Case Study: Robotic Algorithm and Technology
Direct industry use	●	●
Spin-off	●	●
Licence	●	●
Consultancy	o	o
Supply staff to industry	o	o
Economic benefits	o	o
Benefits to Society	o	o