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**Research Grants Council**
**Theme-based Research Scheme**

**Research Themes and Grand Challenge Topics**
(subject to the call circular from RGC in July 2024)

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## Theme 1 – Understanding Diseases and Disease Prevention

This theme aims to understand disease mechanisms and manage diseases of special importance in Hong Kong and to contribute to individual health and the well-being of society at large.

Proposals are sought to address one or more of the following:

1. Infectious Diseases
2. Understanding Disease Mechanisms to Improving Health
3. Stem Cells and Regenerative Medicine
4. Disease Prevention and Management

Priority will be given to proposals that:

- develop new knowledge in fundamental mechanisms of disease;
- solve major applied problems in health; develop, use, and / or evaluate novel innovative technologies; or
- provide new knowledge on diseases and conditions of special importance to Hong Kong.

Proposals should give the rationale for the diseases and the approaches selected and how new funding would accelerate discovery or translation that would not be accomplished by current RGC funding mechanisms.

Support could also be used for improving and maintaining individual or population health; building a cadre of future scientists; making the transition to international prominence.

### *Topic 1: Infectious Diseases*

Research proposals should focus on infectious diseases which are prevalent in Hong Kong and neighbouring region, or areas that the Hong Kong academic community has a competitive edge. Possible areas include, but are not limited to:

- hepatitis viruses;
- influenza;
- EBV and nasopharyngeal carcinoma;
- HIV;
- drug-resistant pathogens;
- emerging infectious diseases; and
- treatment / drug discovery.

### *Topic 2: Understanding Disease Mechanisms to Improving Health*

Research proposals should focus on interdisciplinary study of fundamental biology to improving health with special relevance to Hong Kong and the region, including but not limited to nasopharyngeal carcinoma, hepatic and lung cancer, mental disorder, neurological diseases and aging, Down's syndrome and eye diseases / disorder. Possible areas include, but are not limited to:

- understanding of the molecular and cell biology of these diseases;
- discovery, development and clinical validation of putative bio-markers;
- novel diagnostic and therapeutic strategies;
- drug development;
- brain function / brain sciences including brain-machine interfaces and brain imaging;
- human microbiome in health and disease; and
- study of genetic determinants of human diseases.

*Topic 3: Stem Cells and Regenerative Medicine*

Research proposals should focus on the study of stem cells and regenerative medicine that exploit the special competitive advantages of the Hong Kong research environment such as access to embryonic stem cell and cost effective animal facilities.  Possible areas include, but are not limited to:

- embryonic stem cells;
- postnatal and adult stem cells;
- induced pluri-potent stem cells and reprogramming;
- tissue engineering and the development of novel technologies for the culture, analysis and imaging of stem cells;
- development of tools for automated analysis of cell lineage, cellular expression, cell migration and cellular morphology during embryogenesis;
- genome editing;
- organ regeneration;
- application for therapeutic development; and
- production of therapeutically relevant cell types from stem cells, their validation in animal models and / or clinical trials and associated manufacturing challenges.

*Topic 4: Disease Prevention and Management*

Research proposals should focus on interdisciplinary studies that identify and promote modifiable factors associated with good health outcomes in individuals throughout their lifespan and communities of Hong Kong and Mainland China that could transform the field of health promotion and public health globally.  Possible areas include, but are not limited to:

- the formulation and testing of bio-psycho-social models of health;
- psychosocial, cultural, environmental and behavioural factors in relation to good health;
- lifestyle interventions to prevent chronic disease;
- the behavioural, communication, and economic science and technologies that identify and promote healthy life-style, including but not limited to developing and mobilizing supportive social relationships / communities for wellness enhancement;
- novel diagnostics;
- vaccine and other prevention measures;
- prediction and prevention of human disease;
- Chinese medicine; and
- disease modelling.

## Theme 2 – Developing a Sustainable Environment

This theme aims to promote a responsible form of development friendly to our environment. Given the trans-boundary nature of environmental problems, changing climate and climate disasters, research collaboration with other associated areas is strongly encouraged.

Under this theme, proposals are sought to address fundamental and applied research issues on one or more of the following topics:

1. Water Pollution and Water Treatment
2. Sustainable Built Environment
3. Energy Efficiency, Conservation, Conversion and Harvesting
4. Air Quality
5. Food Production and Food Security

Priority will be given to proposals that:

- provide novel analytical approaches;
- develop innovative technologies;
- provide fresh empirical evidence, science-based simulation and modelling; and
- provide practical insights to educate the public and to assist policy decisions by government and industry on issues of importance to Hong Kong, Greater Bay Area and / or the Belt and Road areas, and beyond.

### *Topic 1: Water Pollution and Water Treatment*

Proposals should focus on, but are not limited to:

- research pertaining to the sustainable use of water resources;
- enhancement of water quality;
- chemical characterization and mitigation of pollutants;
- social and economic impacts of water pollution;
- innovative technologies on water treatment;
- identification of the sources and transport mechanisms of the pollutants; and
- protection of the health and beneficial uses of the aquatic ecosystem in Hong Kong, Greater Bay Area and / or the Belt and Road areas.

### *Topic 2: Sustainable Built Environment*

Proposals should focus on, but are not limited to, enhancing the sustainability and adaptability of the built environment, especially issues relating to the provision of high quality working and living environments, green buildings, and the social, economic and environmental impact of urban development. Sub-topics suggested are:

- integrated building design;
- green building materials and technology;
- indoor air quality;
- green, smart and sustainable urban planning;
- energy conservation; and
- waste management including the use of bio-inspired solutions.

*Topic 3: Energy Efficiency, Conservation, Conversion and Harvesting*

Proposals should focus on, but are not limited to, multidisciplinary research on:

- photovoltaics;
- solid-state lighting;
- high efficiency energy conversion and storage systems, including battery technologies;
- smart grids;
- green energy production such as hydrogen and harvesting of solar, wind, and wave energy;
- carbon neutrality;
- life cycle analysis for assessing environmental impact; and
- biological technology such as plants for energy conversion and harvesting.

The proposed projects should also aim at creating intellectual property rights and patents to help transform Hong Kong into a knowledge-based economy.

*Topic 4: Air Quality*

Proposals should focus on, but are not limited to, the challenge to improve the air quality of Hong Kong, Greater Bay Area and / or the Belt and Road areas through integrated multidisciplinary research and involvement of stakeholders including the government, business and NGOs. Radically new approaches directed towards monitoring, experimental modelling, mapping, chemical characterization and mitigation of air-borne pollutants to allow the formulation of appropriate policy and strategy of air quality management are encouraged.

*Topic 5: Food Production and Food Security*

Proposals should focus on food production and food security including, but not limited to:

- agricultural biotechnology and genetic modifications of crops, production animals and agricultural microorganisms;
- microbial resistance in crops and production animals;
- innovation in vaccines for crops and production animals;
- food safety, food toxicity; and
- food supply chain and waste treatment.

## Theme 3 – Enhancing Hong Kong's Strategic Position as a Regional and International Business Centre

To capitalize on the emerging economic significance of China, particularly in the Greater Bay Area and / or the Belt and Road areas, it is of paramount importance for Hong Kong to deepen its appreciation of the dynamic development of regional Asian economies so as to enhance its position as an economic hub.

Under this theme, proposals are sought to address fundamental research issues on one or more of the following topics:

1. Hong Kong's Future as an International Financial Centre
2. Promoting Hong Kong's Business through Networking Capability
3. Promoting Hong Kong as a Centre of Excellence for Business Services
4. Innovation Ecology and Business Creation in Knowledge Economy
5. Financial Technologies (FinTech) and Regulatory Technologies (RegTech)

The success of various business sectors in Hong Kong can be attributed to multiple enabling factors including Hong Kong's global connectivity and strong links with the Mainland; its investments in human resources (including, but not limited to education); and Hong Kong's legal and governance systems. These enablers are considered relevant to all the topics identified under this theme.

Priority will be given to proposals that:

- provide novel analytical approaches;
- develop innovative methodologies;
- offer new theoretical insights; and
- generate fresh empirical evidence that yield practical insights for policymakers and relevant stakeholders on issues of importance to Hong Kong's economy including but not limited to the barriers or problems that may have hindered Hong Kong's adoption of new technologies.

Proposals should have strong foundations in theory, and be grounded in the extant research within the relevant fields.

### Topic 1: Hong Kong's Future as an International Financial Centre

Research proposals should advance analytical, empirical and institutional knowledge that is relevant to enhancing Hong Kong's role as a leading international financial centre. Topics of interest include, but are not limited to:

- the economics of financial innovation;
- Hong Kong as an international asset management centre and risk management centre;
- issues relating to market microstructure in Asian financial markets;
- Hong Kong as a global offshore Renminbi hub;
- consequences of the liberalization and global integration of Chinese financial markets;
- the economic geography of Hong Kong's strategic location; and
- the development of corporate social responsibility, including but not limited to green financing.

### Topic 2: Promoting Hong Kong's Business through Networking Capability

Research proposals should advance analytical, empirical and institutional knowledge that is relevant to enhancing Hong Kong's networking capability relating to the flows of goods, services and capital across global markets. Topics of interests include, but are not limited to:

- the contribution of transport and logistics networks to Hong Kong's growth and future development;
- Hong Kong's role as an orchestration point for supply network coordination in emerging economies;
- the significance of cultural and linguistic factors in expanding business networks;
- multiculturalism as a business capability;
- business applications of new domains in social media and crowd sourcing; and
- the impact of social networks on corporate decisions and strategies.

*Topic 3: Promoting Hong Kong as a Centre of Excellence for Business Services*

Research proposals should advance analytical, empirical and institutional knowledge that is relevant to enhancing Hong Kong's role as a centre of excellence for innovation in business services. Topics include, but are not limited to:

- mechanisms for inter-organizational learning and innovation;
- Hong Kong as a regional intellectual property trading centre;
- optimization methods for service delivery;
- extensions to the provision of public and social services;
- extensions to the cultural and media industries;
- the cultural and social psychological aspects of employee motivation in service organizations;
- impact of environmental, social and governance (ESG) on business practices; and
- Hong Kong as a centre for international legal and dispute resolution services.

*Topic 4: Innovation Ecology and Business Creation in Knowledge Economy*

Research proposals should advance analytical, empirical and institutional knowledge that is relevant to enhancing the ecosystem and the creation and incubation of new business and the revitalization of existing enterprises. Areas of study include, but are not limited to:

- technology commercialization;
- family businesses;
- business alliances;
- governance mechanisms and capital allocation in high-growth businesses;
- growth strategies for small and medium sized enterprises;
- structure and processes in social enterprises (for-profit entrepreneurs, public-private alliances, and non-governmental organizations);
- the culture and social psychology of entrepreneurs;
- application of design thinking;
- strategies to increase creative thinking and creativity;
- entrepreneurial decision-making;
- talent development and retention to foster entrepreneurship and innovation;
- risk-taking and opportunity identification; and
- corporate entrepreneurship.

The research should encourage the creation, application, and transfer of knowledge with government agencies and industrial sector in Hong Kong, and possibly the Mainland and the region, and hence enhance the impact of the research through commercialization.

*Topic 5: Financial Technologies (FinTech) and Regulatory Technologies (RegTech)*

Research proposals should advance analytical, empirical and institutional knowledge that is relevant to enhancing the development and transformation of FinTech and RegTech in Hong Kong with a view

to bringing societal and / or economic impact to Hong Kong.  Topics of interests include, but are not limited to:

- digital currency;
- cybersecurity;
- payments and securities settlement;
- investment, equity crowdfunding, peer-to-peer lending and trading platforms;
- blockchain, distributed ledger technologies and cryptocurrency;
- wealth management (WealthTech);
- insurance models and products (InsurTech);
- compliance and risk monitoring technologies; and
- open banking and data privacy, residence and protection.

**Theme 4 – Advancing Emerging Research and Innovations Important to Hong Kong**

This theme aims at advancing our knowledge and facilitating the development and application of research innovations important to Hong Kong. This will contribute to powering world-class industries and developments at the local, national, regional and global levels, and capitalize on Hong Kong's existing strengths in research and innovation. The theme echoes the great importance the Government attaches to the innovation and technology industries as well as research in humanities and social science.

Proposals are sought to address one or more of the following topics:

1. Big Data and Artificial Intelligence
2. Imaging, Robotics and Smart Manufacturing
3. Urban Infrastructure and Smart City
4. Education and Digital Citizenship
5. Quantum Technology
6. Integrated Circuits

The research should impact on the creation, application, and transfer of knowledge in Hong Kong, and possibly the Mainland and the region, and should foster interaction with our neighbours and help Hong Kong researchers leverage their research strengths.

Priority will be given to proposals that involve inter-institutional and cross-disciplinary collaborations, both basic and applied. Partnering with stakeholders including Government agencies and the industrial sector is encouraged.

*Topic 1: Big Data and Artificial Intelligence*

This topic covers computational and analytical approaches suitable for handling very large and potentially heterogeneous data as well as advances in artificial intelligence for societal, health and economic benefit. Activities may range from machine-learning research, development of distributed computational approaches and cloud-enabled implementation technologies, to cross-domain big data analytics. Research proposals should be motivated by applications relevant to Hong Kong, including but not limited to:

• data-driven policy-making;
• increasing economic prosperity;
• enhancing healthcare applications;
• improving educational opportunity and quality of life;
• enhancing safety of the society;
• art technology and digital humanities;
• e-finance;
• mobile data; and
• the internet-of-things.

Given the massive scale, keen competition and daunting challenges, substantial support in kind or in other forms from major players, in particular commercial entities which are deeply involved in this area, would be a distinct advantage for any project to be considered favourably.

*Topic 2: Imaging, Robotics and Smart Manufacturing*

Research proposals should focus on:

(1) image acquisition, processing and analysis, sensor technologies and visualization for sub-topics, including but not limited to:
- disease detection, diagnostics and monitoring;
- sensing and actuation; and
- real-time 3-dimensional modelling;

(2) smart robotic technologies in applications, including but not limited to:
- autonomous navigation;
- bio-manipulation;
- bio-inspired technology;
- rehabilitation and gerontechnology;
- digital twins;
- manufacturing;
- services in high-risk environments; and
- deep space, deep earth, deep sea and polar exploration; and

(3) smart manufacturing in technologies, including but not limited to:
- bio-printing;
- medical devices; and
- complex multi-material composites.

Investigations on nanoscale technologies and manufacturing and the social implications of human-machine interactions are also encouraged.

*Topic 3: Urban Infrastructure and Smart City*

This grand challenge in urban infrastructure primarily addresses the research and implementation of the "Smart City", which involves the use of technologies to provide intelligent response to the needs of the city.  Proposals should focus on smart buildings, intelligent transportation systems, urban geo-informatics which studies, including but not limited to:

- the structure, algorithms, behaviour, and interactions of natural and artificial systems in the urban context;
- resilience of infrastructure networks such as water, power, gas, transportation, and communication; and
- smart ID and its applications.

*Topic 4: Education and Digital Citizenship*

Research proposals should focus on advancing digital solutions on:

- learning;
- scientific reasoning;
- development of twenty-first century skills;
- influence of students' sense of belonging and life experiences, and understanding of learning;
- teaching creativity;
- problem-solving and innovation;
- social inclusion;
- equity and the digital divide;
- life-long learning and policy-implications; and

- the role of other stakeholders including parents, employers and professional associations.

Research is also encouraged on how the provision of digital literacy evolves as labour market demands and education systems change.

## *Topic 5: Quantum Technology*

Research proposals should focus on advances in quantum information science and engineering, and their applications to manufacturing, health and societal benefits. Topics include but are not limited to:

- quantum computing;
- quantum communications;
- quantum sensing and metrology; and
- quantum biology and chemistry

Most of these topics are interdisciplinary in nature, covering broad areas such as quantum error correction, hybrid quantum algorithm, massively parallel and compact edge quantum computing, quantum key distribution and the Quantum Internet. Collaboration among teams with different expertise and implementation capabilities would be considered favourably.

## *Topic 6: Integrated Circuits*

Research proposals should include, but are not limited to:

- integrated circuit design tools;
- key equipment and key materials such as high-purity targets;
- advanced integrated circuit technology and characteristic processes such as insulated gate bipolar transistor and micro-electromechanical system;
- advanced storage technology;
- flexible electronics;
- silicon carbide, gallium nitride, and other wide-bandgap semiconductors; and
- advanced optoelectronic integrated circuits and packaging techniques.

*Grants Team, ORKTS (27 May 2024)*