MARINE CLIMATE CHANGE SCIENCE (MCCS) PROGRAMME
GRANT CALL 2

1. Definitions

1.1 In this Call for Proposal, unless the contrary intention appears: -

(a) "Host Institution" means the body or institution or administering organisation named in the Letter of Award as the "Host Institution" as the body responsible for undertaking and managing the Research;

(b) "Partner Institutions" means the bodies or institutions named in the Letter of Award as the "Partner Institutions" as the bodies responsible for working together with the Host Institution to undertake the Research;

(c) "Institutions" means collectively the Host Institution and the Partner Institutions and "Institution" shall mean any one of them;

(d) "Investigators" means collectively, the Lead Principal Investigator, Team Principal Investigators and Co-Investigators;

(e) "Collaborator" means any company, institution, incorporated body or other industry or academic collaborator, which is not an Institution or an Investigator but is to be engaged in the Research in collaboration with the Institutions or any of them;

(f) "Lead Agency" means the government agency leading and driving the Research;

(g) "Other Agencies" means the government agency/agencies participating in the Research other than the Lead Agency; and

(h) "Research" means the research project selected and awarded a grant under the Marine Climate Change Science programme.

2. Introduction

2.1 Climate change is recognised as an existential threat, and its effects are currently felt by countries around the world, especially low-lying small island nations like Singapore, where retreat from impact frontlines is not an option. There is urgent need to conduct marine climate change-related research not only to understand the complex mechanisms that drive sea-level rise and destabilise ecosystems, but to also understand processes and responses at the ecosystem, habitat and organismal levels, in order to future-proof the marine environment to sustain the health and productivity of our coastal waters. Combined outcomes from such applied and baseline research should be geared towards enabling translational interventions and programmes that practitioners across the public and private sectors – in Singapore and elsewhere – can adopt, apply and implement, to realise greater resilience in environment, society and economy that will evolve and adapt in tandem with a changing climate.

2.2 The Marine Climate Change Science (MCCS) programme serves as a national focal point for multi-disciplinary marine climate change research, to help address the challenges faced by our coastal and marine environment arising from climate change. Led by NParks, the MCCS programme is part of overall efforts to transform Singapore into a City in Nature, as well as contribute towards a nationwide effort to build climate resilience.

2.3 With an emphasis on multi-disciplinary and translational research, the MCCS programme seeks to advance the core sciences of marine climate change, and inform the development of evidence-based interventions and solutions to safeguard our coastal and marine ecosystems against the effects of climate change, such as sea level rise, increasing sea surface temperatures, and extreme storm events. This will be achieved through the integrated research efforts in 3 core research verticals and 2 enabling horizontals:

- Vertical 1: Blue Carbon Science
- Vertical 2: Eco-Engineering
- Vertical 3: Ecological Resilience
- Horizontal 1: Marine Climate Impact
- Horizontal 2: Community-Driven Climate Resilience Planning

[Please see Annex A for further details on each of the verticals and horizontals]

3. Call Topic

3.1 Please refer to Annex B for the details of the Call Topics.

4. Eligibility

4.1 Principal Investigators (PIs) from all Singapore-based public research institutes (RIs) (e.g., Institutions of Higher Learning (IHLs) and A*STAR RIs), companies, company-affiliated research laboratories or institutions and not-for-profit entities are eligible to apply.

4.2 The Lead PI who leads the Research must be based in Singapore[1]. Collaboration with Singapore-based organisations and experts, in the capacity of Co-Investigator (Co-I) or as Collaborator, is strongly encouraged in line with the MCCS programme's emphasis on multi-disciplinary and translational research. Collaboration with foreign organisations and experts in the capacity of Co-I or as Collaborator is allowed, and strongly encouraged for areas with potential for introduction of new research capabilities and transfer of technical expertise into Singapore. Research work should be done in Singapore, and should not be carried out overseas unless expressly approved by the grantor.

4.3 Grant applicants are strongly encouraged to collaborate with industry partners to develop innovative solutions that can address the call objectives and demonstrate strong potential for real-world application within and beyond Singapore.

[1] Lead PIs must have a minimum of 9 months employment with the Host Institution, starting 3 months from the closing date of the Grant Call.

4.4 Where applicable, we encourage the integration of relevant real-world conditions or social and behavioural research to complement the R&D work under these grant calls, to ensure the practicality, user-centricity and acceptability of the solutions proposed.

4.5 PIs are allowed to submit proposals for one or more of the Call Topics above. Please clearly indicate the Call Topic that the proposal will address in the Proposal Template.

4.6 R&D proposals already funded by other government agencies will not be considered under MCCS. PIs will need to declare their other funding sources as well as participation in other funding initiatives during application. Proposals with similar scope, which are currently under evaluation by other funding initiatives, will not be considered until the results from the other funding initiatives are finalised.

4.7 Funding for private sector entities for (i) research projects with a total project budget more than S$500,000 or (ii) test-bedding/demonstration/scale-up projects with a total project budget more than S$2 mil, would be conditional on collaboration with a public research performer. Nonetheless, below these quanta, private sector Lead PIs are also strongly encouraged to collaborate with public research performers as far as possible.

5. Funding Support

5.1 When budgeting for funding under MCCS, the total cost of the project should include all approved direct costs[2] and indirect costs[3]. All expenditure should be budgeted inclusive of any applicable Goods and Services Taxes (GST) at the prevailing rates. The Lead PI should exercise due diligence and ensure that the proposed budget is correct and free from error.

5.2 Direct costs are incremental cost required to execute the programme. Supportable direct costs can be classified into the following cost categories:-

(a) Expenditure on manpower (EOM);
(b) Equipment;
(c) Other Operating Expenses (OOE); and
(d) Overseas Travel.

5.3 For all direct cost items proposed for the project, please note that:

(a) Host Institutions must strictly comply with their own procurement practices;
(b) Host Institutions must ensure that all cost items are reasonable and are incurred under formally established, consistently applied policies and prevailing practices of the Host Institution; and
(c) All items/ services/ manpower purchased/ engaged must be necessary for the R&D work.

[2] More information on the non-fundable direct costs of research can be found in Annex C.
[3] Indirect costs are costs that are incurred for common or joint objectives and therefore cannot be identified readily and specifically with a particular sponsored research project, but contribute to the ability of the Institutions to support such research projects (e.g., providing research space, research administration, utilities), and not through the actual performance of activities under the sponsored projects.

5.4 For proposed Equipment to be purchased, please ensure that they are currently unavailable in the Host Institution. In the event where the Lead PI is aware that a similar Equipment is available in the Host Institution, but has still proposed to purchase such Equipment, the Lead PI has to provide the necessary justifications for the MCCS Programme Office's approval. Please also note that there is a requirement to share Equipment purchased using NRF funds with other researchers in Singapore.

5.5 At the end of the Research, the MCCS Programme Office may enter a negotiation with the Host Institution to transfer ownership of any of the Assets to the MCCS Programme Office or any other person or body at no cost.

5.6 MCCS will support 100% of the approved qualifying direct costs of a project for Singapore-based IHLs/public RIs. Private sector entities[4] will qualify for up to 70%[5,6] of the approved qualifying direct costs of a project, depending on the entities involved:

(a) 30% for all non-Singapore entities based in Singapore (including non-Singapore not-for-profits);

(b) 50% for Singapore Large Local Enterprises; and

(c) 70% for Singapore Small Medium Enterprises, start-ups and not-for-profits.

5.7 Support for indirect costs, in the form of overheads, will only be provided for Singapore-based IHLs/public RIs. Funding support of 30% of the total qualifying approved direct costs will be allowed. Host Institutions will be responsible for administering and managing the support provided by MCCS for the indirect costs of research. Indirect costs must be specifically provided for in the grant, and approved by the Grantor based on the nature of the research.

5.8 Please refer to the document "Guidelines for the Management of Research Grants" for information on Disbursement of funds, Variation requests, Audit and Progress reports and List of Non-Fundable Direct Costs for Research Projects.

5.9 Collaborators are not permitted to receive, directly or indirectly, any part of the funding, whether in cash or in the form of assets acquired using the funding or otherwise unless expressly approved by the grantor. All assets acquired using the funding must be located in Singapore and maintained within the control of the grantees.

6. Intellectual Property Rights

6.1 Government agencies who are Institutions or Collaborators may co-own any Intellectual Property (IP) arising from the Research. If Government agencies choose not to co-own IP, they shall make this position known prior to award.

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[4] Definitions of the different private sector entity types can be found in Annex D.

[5] Exemption: Temasek Life Sciences Laboratory will qualify for up to 100% of the approved qualifying direct costs and up to 100% of the indirect costs of a project.

[6] All funding support levels are accurate as of grant call launch, and may potentially be subject to future review and revision.

6.2 The Institutions shall keep and maintain a full, comprehensive and updated list of all Research IP, which shall be made available to MCCS Programme Office for inspection at any time.

6.3 The parties shall use best efforts to ensure that Research IP is properly managed and wherever feasible, fully exploited and commercialized. When required to do so by MCCS Programme Office, the Institutions shall attend such meetings as MCCS Programme Office may direct to discuss the potential for exploitation and commercialization of Research IP.

6.4 The Government and public sector agencies shall reserve a non-exclusive, non-transferable, perpetual, irrevocable, worldwide, royalty-free right and license to use, modify, reproduce and distribute the Research IP for non-commercial, R&D and/or educational purposes.

6.5 For projects funding non-Singaporean entities[7], a Singapore Technology Licensing Office (STLO) must be appointed regardless of the involvement of the public research performer. The STLO will assist to manage RIE-sponsored foreground IP for maximum utility in Singapore, and provide fair access to Singapore entities in the public and private sector.

7. Data Management

7.1 USS domain agencies are compiling a metadata catalogue to improve data discoverability for researchers. It seeks to encourage early (i.e. pre-award) data-related discussions between Lead agencies and Investigators and will serve as a central reference for datasets available within agencies for request, to be used exclusively for the Research.

7.2 Interested Investigators from

(a) Public Institutions (i.e. AUs, polys, A*STAR Research Entities, and Temasek Life Sci Lab) may approach your respective Research Offices, who will assist to write in to request for the metadata catalogue.

(b) Local Entities (that are not part of the list of public institutions) may write in to request for the metadata catalogue directly. If approved, an authorised signatory from the organisation must agree to a non-disclosure undertaking before the metadata catalogue is shared.

Agencies will assess the requests based on the grant call topic (e.g. if sharing of agencies' data is indeed useful given the nature of the topic) and may request for further substantiations. Please note that agencies reserve the right to approve/deny any requests for the metadata catalogue, and that any data subsequently requested from the Government and/or public agencies will require the signing of separate non-disclosure agreements (NDAs).

[7] Non-Singaporean entities are defined as companies with less than 30% local shareholding, determined by the ultimate individual ownership.

7.3 To facilitate data sharing, Host institutions are required to submit cleaned data that is collected or generated in the Research as identified by the MCCS Programme Office. Please note that data may be shared with other publicly funded projects in the future through the metadata catalogue, unless they are commercial data or bounded by NDAs, to maximise synergies across projects and minimise duplicative works.

8. Post-Research Support

8.1 Based on agencies' experience, there is a need for a handover period as often, there are practical issues such as debugging or additional tests for compatibility with government systems required, depending on the nature of the research project. In this regard, to better reap project outcomes, the Host Institution shall ensure that the Lead PI, Co-I and Collaborators shall provide all necessary support for continued product development and technology translation of the Research, for a period of up to 9 months ("**Handover Period**"), as may be required by the MCCS Programme Office, depending on the nature of the project. The support required shall include but not be limited to the carrying out of training sessions and conducting of debugging, user acceptance tests and compatibility tests with existing government systems. The detailed terms of the Handover Period for each Research would be set out in the written agreement referred to at para **Error! Reference source not found.** below. For the avoidance of doubt, the duration of the Research shall include the Handover Period.

9. Research Integrity Policy

9.1 The Host Institution shall ensure that all necessary approvals for the research, including all ethics approvals, have been granted prior to the commencement of any research activities.

9.2 The Host Institution is responsible for establishing a research ethics and integrity policy and enforcing its compliance. In carrying out any Research, the Host Institution shall agree to:-

(a) Comply with the provisions of any relevant laws of the Republic of Singapore, statutes, regulations, by-laws, rules, guidelines and requirements applicable to it, as well as all applicable policies and procedures adopted by MCCS as the same may be amended or varied from time to time;
(b) Have in place a research integrity policy which sets out the principles for the responsible conduct of research and procedures for investigating and responding to accusations of misconduct;
(c) Provide training in responsible conduct of researchers, for all researchers;
(d) Be held responsible for the conduct of research and researchers; and
(e) Ensure compliance with best practice, as well as the ethical, legal and professional standards relevant to the research.

9.3 All PIs, research personnel and all other persons involved in the Research must comply with the research ethics and integrity policy, and other approval requirements needed to carry out the research programme. The PIs should undertake the following declaration:

(a) In carrying out Research, agree to comply with the provisions of any relevant laws of the Republic of Singapore, statutes, regulations, by-laws, rules, guidelines and requirements applicable to it, as well as all applicable policies and procedures adopted by the MCCS programme as the same may be amended or varied from time to time;

(b) Agree to hold primary responsibility for the responsible conduct of research, and shall abide and comply with the ethical, legal and professional standards relevant to research, in accordance to the research integrity policy of the Host Institution; and

(c) Declare any potential conflict of interest that may arise from the purchase of equipment/ physical items or engagement of manpower/ services in the course of carrying out Research.

10. Evaluation Process

10.1 Proposals will be evaluated based on the following criteria:

(a) Potential Contribution to MCCS Objectives

- Relevance of proposed research in contributing to objectives/targets stated for the MCCS Call Topic.

(b) Potential for Breakthrough and Innovation

- Quality and significance of proposed research, including value for money, and the potential for breakthrough/innovation to advance knowledge and understanding within its own field or across different fields.

(c) Potential for Application and Deployment in Singapore and Commercialisation/Export[8]

- Potential for application of research outcomes in Singapore by a public agency and potential for solutions to be replicated in Singapore beyond a single site/project.
- Feasibility for commercialisation/ export in areas where Singapore has a competitive advantage.

[8] To strengthen the commercialisation aspects/considerations of research outcome, USS Innovation & Enterprise (USS I&E) Office may be brought in to aid in the evaluation of the proposals.

(d) Execution Strength and Technical Competency of Research Team

- Quality of plans for execution and delivery of the research programme and goals, including the appropriateness of the proposed milestones and deliverables (specific to evaluation of full proposal applications).
- Quality, significance, and relevance of the recent research record of the Lead PI and Co-Is and the strength of the applicant group, including likely synergy in delivering research and potential for international leadership.

11. Letter of Award & Acceptance

11.1 The MCCS Programme Office is under no obligation to award research grant in whole or in part to any proposal. The MCCS Programme Office may require proposals to be revised as it sees fit to enhance research outcomes, facilitate integration of research concepts and technologies, and optimise funding resources. **The MCCS Programme Office's decision on project and funding support will be final** and shall be abided by the applicants.

11.2 Successful applicants will be informed by the MCCS Programme Office of the award of the grant. Notification in the form of a Letter of Award will be sent to the Director of Research (DOR) for the respective Lead PI's Host Institution, and copied to the Lead PI.

11.3 The Letter of Award will include the following:

(a) Statement of Acceptance;
(b) Terms and Conditions of the Grant;
(c) Guidelines on Grant Management;
(d) Performance Indicators and Milestones; and
(e) Schedule and Budget Details.

11.4 The Acceptance Form must be acknowledged by all of the following:

(a) The Director of Research (or equivalent);
(b) The PI; and
(c) The Co-Investigators (Co-Is).

11.5 Upon acceptance of the MCCS grant, the PI, Co-Is and Host Institution are bound by these clauses and all other terms as specified in the Letter of Award.

11.6 The PI or Co-Is cannot also be the authorised officer representing the Institution (i.e. DOR). In such cases, another officer duly authorised by the management of the Institution shall approve on its behalf.

11.7 The Acceptance Form and Annexes (if applicable) should be returned to MCCS Programme Office within a pre-determined time frame from the date of the Letter of Award. The date on which the Statement of Acceptance is signed shall be taken as the date of acceptance of the Award.

11.8 After the acceptance of the Award, as may be required by Agencies, the Lead Agency, Host Institution, Partner Institutions, Collaborators and/or Other Agencies shall enter into a written agreement that is consistent with the obligations assumed under this Research and that includes conditions about: -

(a) the role of each party in the Research;
(b) the provision of cash or in-kind contributions to the Research by each party;
(c) the work to be undertaken by each party and its technical/scientific contributions;
(d) terms relating to Intellectual Property ownership and commercialization;
(e) the detailed terms of and each party's obligations during the Handover Period; and
(f) any other obligations to be fulfilled as laid out in this set of guidelines.

11.9 The Investigators are responsible for putting in place research collaboration agreements where and when applicable.

12. Submission Instructions

12.1 Please download the Integrated Grant Management System (IGMS) User Guide from the IGMS system at https://www.researchgrant.gov.sg/Pages/TrainingGuides.aspx for all instructions and guidelines on the submission process and information relating to the Grant Call.

12.2 Lead PI and Co-Is from organisations that are not registered in the IGMS are advised to contact MCCS@nparks.gov.sg as soon as possible. Applicants are advised to allow sufficient time (at least 2 weeks) for their respective organisation to be registered, including registering their respective researcher profiles in the IGMS prior to submitting proposals. Refer to Annex E and the Grant Call FAQs for further information.

12.3 All applications and supporting documents for the MCCS Grant Call must be submitted through IGMS at https://www.researchgrant.gov.sg/. Once PIs have submitted their documents online, their applications will be routed to the Director of Research (or equivalent) of their respective Host Institution for online endorsement. Separate submissions outside of IGMS will not be considered.

12.4 Please note that it is mandatory for applications to be lodged in the IGMS system and endorsed by **17 June 2024, 2:00pm, Singapore time (UTC +08:00). Late submissions or submissions from individual applicants without endorsement from the Host Institution will not be entertained.**

12.5 For enquiries on the Grant Call, please email to MCCS@nparks.gov.sg. For other enquiries pertaining to IGMS system, please email IGMS helpdesk at Helpdesk@researchgrant.gov.sg.

12.6 Applications are considered to be successful only if all relevant documents are submitted in IGMS. The Research Administrative Office from IHLs or equivalent outfits in companies are required to ensure information submitted by their researchers for the grant call are compiled according to the requirements set out. Incomplete submissions may be rejected. A soft copy of the application documents should also be sent by email to the MCCS Programme Office at MCCS@nparks.gov.sg. The application documents required for the submission can be downloaded from the 'Research Proposal' section under "Research Details" after the applicant login to IGMS and navigate to "Proposals", view "Proposal information". The documents required to be submitted are:

(a) Full Proposal Template (Form A);
(b) Budget Template (Form B); and
(c) Capability Indicators Template (Form C)

It is advised to restrict each attachment to be less than 4MB.

12.7 Please follow the naming convention and format for labelling of softcopy attachments:

Attachment	**Naming Convention**	**Format of attachment**
Full Proposal Template	*[Topic Code]* FP_ *Project title*	MS Word
Budget Template	*[Topic Code]* Budget_ *Project title*	MS Excel
Capability Indicators Template	*[Topic Code]* Indicators_ *Project title*	MS Excel
CVs	*[Topic Code]* CV_ *Project title*	MS Word
References (optional)	*[Topic Code]* References_ *Project title*	MS Word

Important: Where relevant privileged or confidential information is needed to help convey a better understanding of the project, such information should be disclosed and must be clearly marked in the proposal.

12.8 In case of discrepancy between the information in the IGMS application form and the attachments uploaded, the information in the attachments shall be taken as final.

12.9 As part of the MCCS programme evaluation process, project submissions will be subjected to a round of peer review by domain experts, followed by evaluation by a Project Evaluation Panel. Research teams applying for the grant call are invited to recommend peer reviewers for the MCCS Programme Office's consideration under the "Reviewers" section of the application form in IGMS.

12.10 The final decision on the peer reviewers will be decided by the MCCS Programme Office. Please refer to the following guidelines when recommending peer reviewers:

(a) Potential reviewers should not have a real or perceived conflict of interest to any members of the research team (e.g., from the same institution as the research team; recently published work with members of the research team; have personal connections with the members of the research team etc.)

(b) Potential reviewers should be experts in the related field. Researchers cited in the reference list may be recommended as potential peer reviewers.

Annex A: Overview of the MCCS programme, and its Verticals and Horizontals

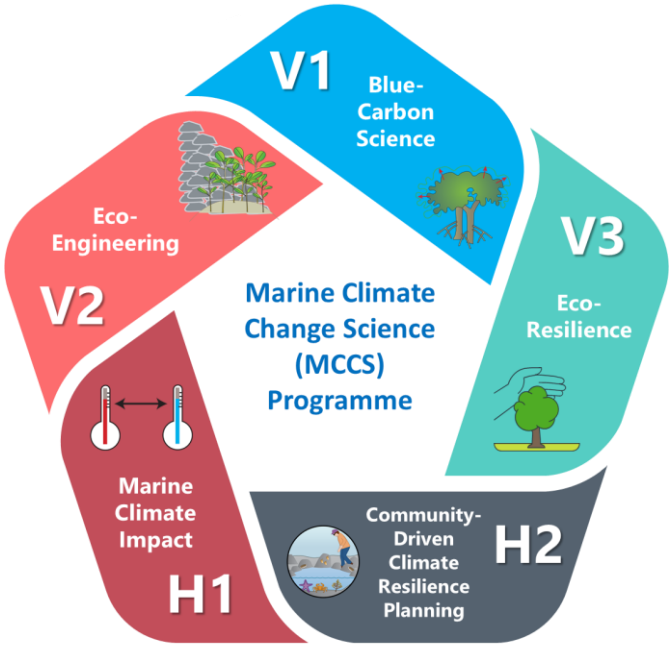
The Marine Climate Change Science (MCCS) programme, developed under NRF's Urban Solutions and Sustainability (USS) domain of RIE2025, serves as a national focal point for multi-disciplinary marine climate change research in order to advance the core sciences of marine climate change, and develop solutions to help address the challenges faced by our coastal and marine environment arising from climate change, such as sea level rise, increasing sea surface temperatures, and extreme storm events. This $25.0M research programme is part of overall efforts to transform Singapore into a City in Nature, as well as contribute towards a nationwide effort to build climate resilience.

Led by the National Parks Board (NParks), the MCCS programme aims to address current knowledge gaps that have been identified in the area of marine climate change. The programme also places an emphasis on multi-disciplinary and translational research, and seeks to inform the development of evidence-based interventions and solutions to safeguard our coastal and marine ecosystems against climate change, including leveraging on our existing natural capital in our blue spaces. This is part of overall efforts to transform Singapore into a City in Nature, as well as contribute towards a nationwide effort to build climate resilience under the Singapore Green Plan 2030.

The MCCS programme looks to draw from the foundational science developed under various past and ongoing programmes, such as the ASEAN-Australia Living Coastal Resources Program (1987-1994), TMSI foundational research (1998-2015), the Technical Committee for the Coastal and Marine Environment (TCCME) (2008 to present) and the Marine Science Research and Development Programme (MSRDP) (2016-2021). The programme also seeks to leverage on existing marine science infrastructure in Singapore, such as the St John's Island National Marine Lab and the Marine Environment Sensing Network.

In line with the programme's emphasis on multi-disciplinary and translational research, the MCCS programme also provides upstream identification of potential pilot test-bedding sites for its various projects, where research teams can work to test ideas and solutions that are being developed under the programme. By focusing research within discrete sites, the programme hopes to encourage research teams to test the range of functions, services, and benefits produced by coastal projects, as part of a systems approach to coastal risk reduction and resilience. This will facilitate realistic understanding of the holistic and multi-dimensional considerations in climate change adaptation, with knock-on benefits beyond single-objective, localised coastal protection from sea level rise and extreme weather storm surges.

The MCCS programme is centred around **3 Core Research Verticals** and **2 Enabling Horizontals**, based on various key strategic research areas identified through dialogue and consultation with domain experts, statutory boards and government agencies.



Core domains and enablers of the MCCS programme

Vertical 1 – Blue Carbon Science

Objective: To provide solutions that will reduce Singapore's carbon footprint while conserving our coastal and marine ecosystems, through building a foundational science for developing a marine carbon credits economy in Singapore.

Vertical 2 – Eco-Engineering

Objective: To protect our coasts against sea level rise and extreme storm events via sustainable engineering measures, while incorporating nature-based solutions which will also enhance our marine environment and create new habitats, thereby providing a sound basis for the sustainable development of Singapore's islands and coasts.

Vertical 3 – Ecological Resilience

Objective: To better understand the impact of climate change on marine species, habitats, ecosystems and connectivity, so as to inform measures to enhance marine ecosystem resilience against climate change-induced disturbances, and safeguard our natural marine capital through science-based management approaches.

Horizontal 1 – Marine Climate Impact

Objective: To develop predictive models for projecting how climate change may alter existing biogeochemical processes in Singapore's marine environment, so as to inform the formulation of interventions and strategies that are relevant to the anticipated changes in our local marine environment.

Horizontal 2 – Community-driven Climate Resilience Planning

Objective: To explore how the social sciences can add important methods and perspectives towards climate change mitigation and adaptation efforts in our marine environment.

Annex B: Grant Call Topics

Grant Call ID/ Topic Code: MCCS_V2_2024-2_T7

Call Topic: Sediment nourishment and other nature-based solutions for climate-resilient soft-sediment coastal habitats

Relevant MCCS Verticals/Horizontals: V2 – Eco-Engineering (main/primary), V3 – Ecological Resilience

1. Background

1.1 Sediment dynamics is a key process that shapes coastal morphology and ecology. Future development and climate change will likely impact the fluxes of sediment in Singapore's coastal landscape in the coming decades. This will lead to changes in erosion and deposition patterns that influence coastal protection strategies, as well as the long-term resilience of soft-sediment coastal habitats like mudflats, mangroves, seagrass meadows and sandy shores. Already, there are areas which experience excessive erosion that require intervention, such as East Coast Park, Sungei Buloh Wetland Reserve and Pulau Ubin.

1.2 To effectively implement nature-based solutions that both protect and allow soft-sediment habitats to persist in the face of rising sea levels and storm surges, we require a better understanding of the current sediment dynamics in Singapore and how it will respond to climate change and coastal development. The project aims to comprehensively characterise the local sediment budget (sources and sinks) in key local soft-sediment habitats and develop predictive models to forecast changes based on various climate and coastal development scenarios.

1.3 Climate change could lead to erosion and "drowning" of these habitats if they do not receive the necessary sediment supply to accrete. To address this challenge, the project will explore the use of sediment nourishment, which has been historically used for beaches, but less so for habitats like mangroves, seagrass meadows or mudflats. This research will help also inform the development of innovative or hybrid solutions that leverage on sediment movement to enable soft-sediment habitats to accrete sustainably.

2. Objectives and Scope of Call for Proposals

2.1 Key Research Questions

(a) What are the sediment budgets (sinks and sources, including mud, silt, sand, and suspended sediments) in key soft-sediment coastal habitats (e.g., mangroves, seagrass meadows, mudflats, sandy shores), and how will these sediment budgets be impacted by:

i. Climate change (e.g., sea level rise, increasing storm frequency) and;
ii. Man-made adaptations to these impacts (e.g., installation of tidal gates and pumping stations, damming up of waterways, reclamation)?

(b) What sediment nourishment or other nature-based solutions (soft or hybrid) can be employed to alter existing or future sediment budgets to protect coastlines from climate-related impacts, and allow soft-sediment natural habitats to accrete?

(c) What are the key environmental, physical, chemical, and ecological considerations[1] when using sediment nourishment to mitigate erosion of soft-sediment coastal habitats, and what potential sediment sources can be tapped on?

2.2 Objectives

(a) To develop models to assess and predict how existing sediment budgets in key soft-sediment coastal habitats in Singapore will respond to the sediment regimes under future climate scenarios and land use plans (including climate adaptation interventions).

(b) To propose and design innovative nature-based solutions or designs (soft or hybrid) that leverage on sediment nourishment or altering sediment regimes to improve coastal protection against storms and sea level rise, and to allow soft-sediment habitats to persist.

(c) To elucidate key environmental, physical, chemical, and ecological considerations[1] for the use of sediment nourishment in key local coastal habitats.

(d) To develop recommendations for the use of sediment nourishment (which has been historically used for beaches, but less so for other habitats like mangroves, seagrass meadows or mudflats) and other innovative nature-based solutions (soft or hybrid) in local soft-sediment habitats.

(e) To test-bed these proposed nature-based solutions at key local coastal habitats facing sediment-related issues (e.g., excessive erosion, burial etc.).

Projects are encouraged to further build upon the above-mentioned objectives, and/or propose additional research objectives.

[1] These could include extrinsic considerations such as hydrodynamics, faunal or floral communities, or intrinsic considerations such as grain size distribution, microbiome, or mineral/chemical composition.

2.3 Technical Deliverables

(a) Description and quantification (e.g., through numerical modelling, field sampling) of the sediment budgets in key soft-sediment coastal habitats like mudflats, mangroves, seagrass meadows and sandy shores in Singapore currently, including the relative contributions of different sources of sediment (e.g., inland and offshore) and their movement.

(b) Create models[2] and datasets to predict the changes of the sediment budgets to various climate change scenarios (e.g., sea level rise, increased wave energy) and future development plans. At least a long-term (i.e., end-of-century) projection should be included.

(c) Preparation of technical guidelines (including design parameters) for sediment nourishment and other nature-based solutions (soft or hybrid) that leverage on altering sediment regimes to improve coastal protection against storms and sea level rise, and to allow soft-sediment habitats to persist.

Projects are encouraged to further build upon the above-mentioned deliverables, and/or propose additional deliverables.

2.4 Impact Outcomes

In relation to the key programme-level deliverables of this vertical, this project should look towards contributing to the following impact outcomes:

(a) The baseline characterisation of Singapore's coastal sediment budget and predictions for future responses to climate change can help inform strategies to protect soft-sediment habitats.

(b) The innovative nature-based solutions (including strategies for sediment nourishment) developed in the project can also potentially be implemented to protect the coast from erosion and to allow key natural habitats to persist under climate change. This will be especially useful in areas where more natural interventions would be preferred (e.g., biodiversity-rich areas, parkland and nature reserves).

2.5 Proposed Study/Pilot Testbed Site(s)

Proposed projects may consider the following sites in Singapore for study and pilot test-bedding, including, but not limited to:

(a) Sungei Buloh Wetland Reserve and Mandai Mangroves and Mudflats (for mangroves and mudflats), Changi Beach Park (for sandy shores and seagrass meadows), and Chek Jawa (for seagrass meadows).

[2] These may require first developing first-order models that predict climate change impacts on hydrodynamics before predicting impacts on sediment regimes.

3. Funding Support

3.1 The Call for Proposals offers funding support up to S$2.0 million (including all direct and indirect costs) (i.e., for meeting all objectives/ deliverables). Proposals more than S$2.0 million will require strong justifications.

3.2 This Call for Proposals offers funding support for a period up to 4 years. Proposals spanning more than 4 years will require strong justifications.

4. Agencies Involved

4.1 The following agencies will be involved in the project to provide technical direction to ensure that the project meets the objectives and scope of the Call Topic, as well as to provide test-bedding sites for the project.

(a) National Parks Board (Lead Agency)
(b) Housing & Development Board (Member Agency)
(c) Public Utilities Board (Member Agency)

4.2 Further clarifications before the project award should surround the stated Call Topic requirements and test-bedding sites. All clarifications and queries should be submitted directly to the MCCS Programme Office at MCCS@nparks.gov.sg during the open grant call process, i.e., research teams should not contact agencies directly. MCCS Programme Office will respond to the clarifications and queries, by periodically updating the Grant Call FAQs document with the relevant answers, on the MCCS programme 2nd Grant Call website and IGMS website to ensure equal accessibility to all additional information. Please refer to these websites for the latest version of the FAQs. Agencies involved will work with research teams to provide further technical advice and discuss test-bedding sites during the proposal scrubbing stage.

Grant Call ID/ Topic Code: MCCS_H1V3_2024-2_T8

Call Topic: Assessing the effects of climate change on coastal water quality

Relevant MCCS Verticals/Horizontals: H1 – Marine Climate Impact (main/primary), V3 – Ecological Resilience (main/primary)

1. Background

1.1 Good water quality is of profound importance to the health of coastal ecosystems, marine aquaculture, and the well-being of people who use coastal waters for recreational purposes. However, coastal water quality is subject to compounded influences from both land and sea, such as freshwater discharges, point and diffuse pollutant loadings, current, tide, wave, and meteorological conditions, and the inherent complexity of coastal systems can complicate water quality responses to the environmental stressors. Changes in coastal water quality may directly affect habitat suitability for aquatic life for example, inter alia, the changes in abundance and distribution patterns of pathogens and harmful algae, which are increasingly ubiquitous worldwide and pose potential threat to aquatic ecosystem and marine aquaculture. The changes in water quality such as shifts in microbial community composition with increase in enterococcus levels or more occurrences of algal blooms can also potentially impact the beneficial uses of coastal waters for recreational activities, due to concerns over public health for the users.

1.2 Adding to the complexity of coastal water quality management, climate change is expected to alter not only environmental conditions primarily in the coastal waters like temperature, current, and sea level but also catchment hydrology due to changes in rainfall and wind patterns. Anthropogenic changes, such as increases in population density in coastal areas and coastal development projects, can also affect levels of sediment, nutrients, harmful bacteria, and other pollutants, further complicating water quality management. These changes have the potential to cause significant changes in the physical, chemical, biological, and microbiological characteristics of coastal waters. Understanding how climate change and anthropogenic influences impact coastal water quality parameters is thus essential to inform effective and robust water management to minimize negative impacts and ensure the sustainability of our coastal environment. Nonetheless, there is still a knowledge gap on the quantitative information on the interactions between climate change, anthropogenic influences, and coastal water quality in the local context.

1.3 The study under this topic aims to establish a fundamental understanding of the relationships between water quality parameters and climate change-induced environmental stressors (e.g. sea level rise, acidification, higher temperature, and precipitation pattern changes), with influences from anthropogenic activities. The outcome of this study can be utilized to support the optimization of monitoring programmes (incl. the selection of location, timing, parameters, and technology) and to prepare for future mitigation measures. The research findings are also beneficial for land-use planning and pollution control to minimize point and non-point pollutant loadings into sensitive receiving waters. In addition, information from the projected water quality changes can contribute to safeguarding public health, the coastal ecosystem, and the marine aquaculture industry, thereby reducing potential socioeconomic losses.

2. Objectives and Scope of Call for Proposals

2.1 Key Research Questions

(a) What are the main drivers of the spatiotemporal heterogeneity in water quality in Singapore's coastal water and how do these drivers affect the water quality?

(b) What will be the separate and combined effects of projected climate changes and main anthropogenic activities on coastal water quality?

(c) What are the effects of the changing coastal water quality on microbial community diversity (including but not limited to enterococcus), harmful algal blooms (HABs) and coastal ecosystem (incl. key marine habitats and biodiversity)?

2.2 Objectives

(a) To identify and quantify the main drivers of the spatiotemporal heterogeneity of water quality parameters[1] in Singapore's coastal water in the 'present-day' scenario. There should be a clear differentiation among climatic[2] and other drivers[3], where applicable.

(b) To evaluate quantitatively the effects of various IPCC climate-change scenarios, and potential main anthropogenic drivers, on Singapore's coastal water quality[1].

[1] The water quality parameters should include, but not limited to, water temperature, salinity, pH, dissolved oxygen, total suspended solids and/or turbidity, nutrients, chlorophyll-a, organic materials, and inorganic pollutants.
[2] Climatic drivers include, but not limited to, temperature, precipitation patterns, wind patterns, sea level, and solar radiation.
[3] Examples of other potential drivers include anthropogenic influences such as land-use changes, population increase, wastewater treatment effluents, industrial effluents, land reclamation, coastal developments, aquaculture, shipping, and potential pollution management measures (e.g. nature-based solutions), as well as geomorphology, tidal processes, biogeochemical processes, transboundary loads and internal loads (e.g. from bottom sediment or submarine groundwater).

(c) To evaluate quantitatively the projected synergistic impact of these water quality[1] changes to microbial community diversity, including but not limited to the occurrences and fates of enterococci (as the faecal indicator bacteria), and HABs (incl. speciation and algal toxins) in the coastal water.

(d) To evaluate quantitatively the projected synergistic impact of these water quality[1] changes to key marine habitats (e.g. seagrass meadows, mangroves, coral reefs) and biodiversity.

Projects are encouraged to further build upon the above-mentioned objectives, and/or propose additional research objectives.

2.3 Technical Deliverables

(a) Identification and quantification of potential drivers that affect the water quality processes and levels of coastal water quality parameters, based on historical data, literature review, and field survey if applicable. It should include scientific understanding and analysis of how the identified drivers interact and affect levels of various water quality parameters[1] in the 'present day' scenario.

(b) Scientific understanding and analysis of the projected changes of the identified drivers over different time horizons consistent with IPCC climate-change scenarios. At least a long-term (i.e. end-of-century) projection should be included.

(c) A water quality model[4] with sufficient spatial and temporal resolution and accuracy[5] for various water quality parameters[1]. The baseline 'present-day' scenario should be calibrated and validated using historical data and additional data that may be required[6].

(d) Assessment and quantification of the projected water quality changes. The assessment should include their significance in local context (incl. benchmarking with either projected or experienced climate-change/anthropogenic impacts in other countries).

[4] The model, baseline and future scenarios, including the software, model setups, model inputs, model outputs (in spatial maps and time series at sensitive marine receptors), data transformation scripts and any related scripts to run the model, and a handbook and training for agencies, shall be transferred to agencies as part of the project deliverables. The model shall comply with government agencies' security requirements, where applicable, and be integrable with NEA's existing operational system if required. Inputs for model development should account for regional and local hydrodynamics, regional and local meteorological influences, main anthropogenic drivers, local and transboundary pollutant loadings, and pertinent physical and biogeochemical processes.

[5] Rationales for the selection of model resolution and quantitative evaluation method and criteria on model performance (calibration and validation) should be clearly indicated in the proposal.

[6] NEA's historical water quality monitoring data for Singapore's coastal water and non-catchment rivers will be provided, while other relevant data can be requested from other agencies.

(e) Assessment and quantification of the projected synergistic impact of these water quality changes to microbial community diversity, including but not limited to the occurrences and fates of enterococci, and HABs (incl. speciation and algal toxins) in coastal water.

(f) Identification of environmental conditions that may result in increased risk of enterococcal contamination under various IPCC climate-change scenarios as well as combined scenarios with projected anthropogenic impacts.

(g) Assessment and quantification of the projected synergistic impact of these water quality changes to key marine habitats (e.g. seagrass meadows, mangroves, coral reefs) and biodiversity.

(h) Recommendations on future monitoring strategy, including key parameters to be monitored and monitoring locations, and frequency. These recommendations should consider the projected impacts under climate-change scenarios and the main anthropogenic drivers. Additionally, they should outline how future monitoring data could be leveraged to enhance future modelling scenarios.

Projects are encouraged to further build upon the above-mentioned deliverables, and/or propose additional deliverables.

2.4 Impact Outcomes

In relation to the key programme-level deliverables of this vertical and horizontal, this project should look towards contributing to the following impact outcomes:

(a) Information on drivers of temporal and spatial distributions of water quality parameters can guide policy on effluent quality control, such as trade effluent regulations under Environmental Protection and Management Act, from relevant industries to minimize discharges to vulnerable receptors in the coastal water.

(b) Model results on the projected changes in coastal water quality parameters under various IPCC climate change scenarios and/or with anthropogenic influences can help to enhance the understanding of local coastal marine environment and contribute to its future preservation and sustainability.

(c) Quantifying the effect of climate change can help to support the review of monitoring campaigns with respect to the changing environmental conditions and improve their adaptiveness and robustness.

(d) The relationships between environmental factors, anthropogenic influences, and the occurrence and fate of enterococcus will facilitate an understanding on the changes in enterococcus under different conditions which will then enable differentiated/site-specific management of recreational beaches for the public (i.e. monitoring, determining suitability for recreational activities, and public communications) and their future planning.

(e) Data and/or model results on the spatial distribution of water quality parameters during different environmental conditions in the coastal water and subject to various anthropogenic influences can be used to plan future aquaculture sites and reduce their vulnerability to HABs. Therefore, promoting a sustainable and resilient aquaculture industry.

(f) Projections of climate-driven changes and main human influences on water quality and their impacts on coastal ecosystems (incl. key marine habitats and biodiversity) can help inform nature conservation and management strategies.

(g) Promote Singapore as a climate-resilient country with proactive and adaptive catchment and coastal management.

2.5 Proposed Study/Pilot Testbed Site(s)

N.A.

(Note: In the event that bacteria (enterococcus) or harmful algal species need to be tested, controlled environments such as laboratory setups should be used. It is only recommended to test their growth and proliferation in the natural environment if the tested subjects are strictly confined and pose no threat to the health of public or aquatic ecosystems, due to the potentially pathogenic or toxic nature of the study subjects.)

3. Funding Support

3.1 The Call for Proposals offers funding support up to S$2.66 million (including all direct and indirect costs) (i.e., for meeting all objectives/ deliverables). Proposals more than S$2.66 million will require strong justifications.

3.2 This Call for Proposals offers funding support for a period up to 3 years. Proposals spanning more than 3 years will require strong justifications.

4. Agencies Involved

4.1 The following agencies will be involved in the project to provide technical direction to ensure that the project meets the objectives and scope of the Call Topic, as well as to provide test-bedding sites for the project.

(a) National Environment Agency (Lead Agency)
(b) National Parks Board (Lead Agency)
(c) Singapore Food Agency (Member Agency)
(d) Public Utilities Board (Member Agency)

4.2 Further clarifications before the project award should surround the stated Call Topic requirements and test-bedding sites. All clarifications and queries should be submitted directly to the MCCS Programme Office at MCCS@nparks.gov.sg during the open grant call process, i.e., research teams should not contact agencies directly. MCCS Programme Office will respond to the clarifications and queries, by periodically updating the Grant Call FAQs document with the relevant answers, on the MCCS programme 2nd Grant Call website and IGMS website to ensure equal accessibility to all additional information. Please refer to these websites for the latest version of the FAQs. Agencies involved will work with research teams to provide further technical advice and discuss test-bedding sites during the proposal scrubbing stage.

Annex C: Non-Fundable Direct Costs for NRF-Funded Projects

This list may be subject to revision.

Type of Expenses	Description
Salaries of Lead PIs / Investigators / Project Leads	Not allowable, to ensure no double-funding of salaries and related costs, as the salaries are already supported from other sources (e.g. faculty salaries are supported separately by the IHL as it is in support of the IHLs' core mission).
Salaries of teaching staff / teaching substitutes	Not allowable, as this is already being supported from capitation grants.
Undergraduate tuition support	Not allowable, as this should be supported under the respective scholarship grants and bursary schemes.
Salaries of general administrative support staff	Not allowable, as this is an indirect cost*.
Costs related to general administration and management	Not allowable, as this is an indirect cost*. This includes common office equipment, such as furniture and fittings, office software, photocopiers, scanners and office supplies.
Costs of office or laboratory space	Not allowable, as this is an indirect cost*. This includes renovation/outfitting costs, rent, depreciation of buildings and equipment, and related expenditures such as water, electricity, general waste disposal and building/facilities maintenance charges.
Personal productivity tools & communication expenses	Not allowable, unless the use of mobile phones and other form of smart devices were indicated in the methodology for the Research/I&E Project. All other costs under this expense type is an indirect cost*.
Entertainment	Not allowable, as this is an indirect cost*.
Refreshment	Not allowable, unless this is related to a hosted conference or workshop for the Research/I&E Project. All other costs under this expense type is an indirect cost*.
Audit fees (Internal and external audit) and Legal fees	Not allowable, as this is an indirect cost*.
Fines and Penalties	
Professional Membership Fees	
Staff retreat and team-building activities	
Patent Application	Not allowable, as this should be supported from overheads given to I&E Office (IEO)*. This includes patent application filing, maintenance and other related costs.

* Note: Indirect cost items should be supported from overheads or other funding sources.

Annex D: Definitions of Different Private Sector Entity Types

S/N	Type	Criteria
1	Non-Singapore entities based in Singapore	• <30% local shareholding , determined by the ultimate individual ownership
2	Large Local Enterprises (LLEs)	• ≥30% local shareholding; and • More than $100M in annual turnover
3	Small Medium Enterprises (SMEs)	• Have Group Annual Sales Turnover of not more than $100M, or maximum employment of 200 employees • To qualify as an SG entity, the entity must also have at least 30% local shareholding, i.e. local equity held directly or indirectly by Singaporean(s) and/or Singapore PR(s)
4	Start-ups	• Registered for less than 5 years at time of grant application • Has individual ownership of more than 50% at reference year; and • Employs at least 1 worker • To qualify as an SG entity, the entity must also have at least 30% local shareholding
5	Not-for-profits	• Registered as a public Company Limited by guarantee, society or charity trust • Main purpose is to support or engage in activities of public or private interest without any commercial or monetary profit, and are prohibited from distributing monetary residual to their own members • To qualify as an SG not for profit, the entity must meet all 3 of the following criteria: (1) Registered and physically present in Singapore; (2) Core funding (i.e. excl. competitive grant funding) is derived entirely/mostly from SG entities; (3) Managed by a Board, which is at least half appointed by SG entities

Annex E: SOP for Creation of New Companies/Institutions in IGMS

1. Before you begin, please familiarise yourself with the various training guides on navigating the IGMS system. The various guides and manuals will help you understand the roles of various users in the IGMS and the application process. These documents can be downloaded from: https://www.researchgrant.gov.sg/Pages/TrainingGuides.aspx

2. Please be informed that companies or institutions who wish to apply for grants in IGMS will need to be registered in IGMS for first time application. The registration of the company or institution within IGMS is mandatory as part of the proposal submission workflow.

3. Please refer to the SOP below for the **creation of a new company/institution within IGMS**.

Steps	Details

1	**[For all]**
	To register a new entry in IGMS, companies/institutions will need to send an e-mail to MCC@nparks.gov.sg with the following details:
	Subject: Creation of new Company/Institution in IGMS for MCCS Grant Call 2, Vertical/Horizontal X, Project X
	
	Details of the New Company/Institution to be Created in IGMS
	• Full Name of Company:
	• Indicate Local Company or Foreign Company:
	• Indicate Public Company or Private Company:
	• UEN (for local company) or CorpPass issued UEN or Unique Identifier (for foreign Company):
	  • For Foreign Company, please provide the screenshot from CorpPass email/profile page indicating the Foreign Entity's CorpPass issued UEN, for verification purpose.
	  • More details on how to register CorpPass for Foreign Company, please refer to the following link: https://www.corppass.gov.sg/help/CP_User_Guide_03B_Admin_Corppass_Admin_Registration_Foreign_Entities.pdf

2	**[For all]** After the respective company/institution has been registered on IGMS, please proceed to register an account on IGMS using CorpPass. To set up a CorpPass account, please visit www.CorpPass.gov.sg. For foreign company users who have an existing IGMS account registered via "For overseas users without SingPass" route, please refer to **step 2a**. An Open Researcher and Contributor ID (ORCID) is also necessary to complete the application. Please register for a ORCID at: https://orcid.org and update the user profile on the IGMS system with the ORCID.

	Thereafter, the Lead PI will be able to add the Co-Is' name in the IGMS when he/she fills up the application form.
2A	**[For foreign company user with existing IGMS account registered via "For overseas users without SingPass" route"]** When registering an account on IGMS using CorpPass, please ensure to use the same email address that was used for the existing IGMS account. In order to continue accessing past transactions in IGMS, it is important that the following steps are done to (i) update the Foreign Entity's CorpPass issued UEN in IGMS (i.e., **step 1**), and (ii) register using CorpPass with the same email address.
3	**[For Lead PI]** Lead PI who will be submitting the application under their company/institution will need to check with his/her company/institution, whether there is already a HI Admin assigned. If not, please refer to **step 3a for the creation of new HI Admin**. To complete a proposal submission, **3 distinct roles** are required from any company or institution to endorse the proposal, namely: • Lead Principal Investigator (PI); • Office of Research (ORE); and • Director of Research (DOR) Grant application is only considered to be submitted after the PI had submitted the proposal on IGMS for ORE's verification and DOR's endorsement.
	[For HI Admin] HI Admin will manage the roles of the users in their company or institution. He/She needs to assign the relevant roles such as "ORE", "DOR", "HI Finance", "HI HR", and "Data Admin", etc to other IGMS users in the company/institution. A HI Admin can concurrently hold the role of Lead PI. He/She will be able to select different profiles upon login to IGMS: • Login as HI Admin – to maintain company / institution & user profiles • Login as PI – to apply for grant call.
3A	**[Creation of new HI Admin]** In the case of creation of new HI Admin, after the company/institution has been created in IGMS, MCCS Programme Office will inform them to nominate an HI Admin. The following steps will apply:

	(1) The company/institution will need to nominate a HI Admin. The HI Admin (including all other intended IGMS users) will need to ensure that his/her CorpPass account and ORCID account has been setup (refer to step 2 for more details). (2) The HI Admin will need to login to IGMS using his/her CorpPass account to register/update his/her profile inside IGMS. Please note that the IGMS would grant him/her the Principal Investigator (PI) role by default. (3) After the HI Admin has been successfully registered in IGMS, the HI Admin will notify MCCS Programme Office with the information below: • Full Name of HI Admin: • E-mail Address of HI Admin: • Designation of HI Admin in his/her company: MCCS Programme Office will arrange with Research Grant Officer (RGO) to change the role of the person from a Principal Investigator (PI) to a HI Admin. (1) After the role has been updated from Principal Investigator (PI) to HI Admin in IGMS, MCCS Programme Office will inform the company/institution. (2) Once granted the role as a HI Admin, he/she can proceed to assign the relevant roles (e.g. “DOR”, “ORE”, etc.) to the various users within his/her organisation.