Funding Instrument:

Department of Science and Innovation and National Research Foundation National Institute for Theoretical and Computational Sciences (NITheCS)

Domain:

Research Chairs and Centres of Excellence (RCCE)

Document:

Call for Expressions of Interest for the establishment of the NITheCS

Date: 10 May 2022

Table of Contents

1. Introduction

The Department of Science and Innovation (DSI) in partnership with the National Research Foundation (NRF) approved the establishment of the National Institute for Theoretical and Computational Sciences (NITheCS). The establishment of the NITheCS will follow a two-step process with Step 1 being the solicitation for Expressions of Interest (EoIs) from self-organised consortia of Higher Education Institutions and qualified partners (in a hub or lead/administrative node and spoke configuration) to make submissions for the establishment of NITheCS in accordance to the criteria and guidelines outlined below. Step 2 will be a call for Full Proposals based on the outcomes of the EoIs.

A Consortium should comprise at most five Nodes, and it is essential that there is a demonstrated involvement of Historically Disadvantaged Institutions (HDIs) in the Consortium. The Consortium members should have a demonstrable record of human capital and research capacity development, and successfully implementing large research projects/programmes focused on theoretical and computational sciences and in line with the NITheCS thematic areas.

For this EoI, consortia, are invited to submit a maximum 10-page submission of how they envision establishing the NITheCS aligned to the guidance as provided below.

2. Background

In 2017 the DSI and the NRF embarked on a process to reconfigure and restructure the National Institute for Theoretical Physics (NITheP) into an entity with a broader focus on the Theoretical and Computational Sciences. An Expert Working Group (EWG) was appointed with the task of developing a science case and possible institutional models for this entity. The science case (which was approved by DSI EXCO on 25 May 2020) covered scientific content, benefit, strategic issues, the institutional structure in each field, collaboration, and increasing research capacity, risks, and economies of scale. The EWG carried out

consultations with the relevant communities of practice (CoP) in the proposed themes, i.e., theoretical physics, mathematics, statistics, astronomy and astrophysics, data science, quantitative finance, quantitative biology and bioinformatics, and climate and earth systems modelling. A potential structure was arrived at by defining the users, setting out the vision, mission and aims, functional requirements, interface requirements, and constraints, and by evaluating relevant benchmarks.

In December 2020, a NITheCS Roadmap (**see Annexure A**) was approved by DSI EXCO to provide a specific high-level roadmap that carefully addresses the risk factors and provides implementation plans. The Roadmap recognizes that the interdisciplinary field of Data Science and the Basic Sciences are driving each other in a period of intense growth. Two key points underscored in the 2019 White Paper on Science, Technology and Innovation are improving inclusion (and building more linkages across the NSI) and enhancing policy coherence and programme coordination in the NSI. It is in line with the policy of enhancing coherence and programme coordination to align theoretical physics, mathematics, statistics, astrophysics, data science, quantitative finance, and data intensive elements of bioinformatics and climate change modelling in a single institute, to have greater impact on human capability and research capacity development and improve financial sustainability.

3.   The NITheCS Vision, Mission, Aims and Themes

3.1   Vision and Mission

The NITheCS is being formed as a national intervention to build human and research capacity in Theoretical and Computational Sciences and to enhance scientific innovation, transformation, and socio-economic development. The NITheCS will therefore bring together researchers in related areas, from relevant universities and other research institutions, to work together to address the Research, Development and Innovation challenges as identified by government, the private sector and civil society.

The vision and mission of the NITheCS are as follows:
- **Vision**: To be a leading Institute of Theoretical and Computational Sciences nationally, regionally, continentally and globally that is recognised for its excellent and impactful research, training, and engagement programmes.
- **Mission**: To build human and research capability in Theoretical and Computational Sciences and to enhance scientific innovation, transformation and socio-economic development.

3.2 Aims

The NITheCS **research aims** are to:
- generate world-leading new knowledge in the basic sciences;
- train high-calibre researchers;
- provide coherence, critical mass and support for a transformed, cutting-edge Theoretical and Computational Science community that fosters excellence and impact; and
- provide a source of expertise which can feed into broad national scientific policies and goals.

3.3 Thematic areas

The NITheCS has been designed as a national multidisciplinary and multi-themed institute. The fundamental basic sciences of theoretical physics, mathematics and statistics, astronomy and astrophysics and quantitative biosciences (including bioinformatics) are the core disciplines underpinning the NITheCS. Quantitative Finance, Earth Systems / Climate change Modelling and Data Science are themes which frame the NITheCS model. The set of themes will be periodically evaluated by the NITheCS Steering Committee. A model in which a new theme can "dock in", or an existing theme can "dock out", is envisaged. However, Theoretical Physics, mathematics, statistics, astronomy and astrophysics and the quantitative biosciences (bioinformatics) are the anchor basic sciences disciplines which will always form the core of the institute.

Each theme entering the new structure has existing communities of practice (CoP) to bring to the NITheCS. It is important to manage these relationships well so as to avoid "stepping on toes" and to develop mutual benefits and synergies. The key founding principles of NITheCS are synergy, inclusivity, multidisciplinarity, economies of scale, sharing of resources, avoiding duplication of resources, and pursuing the principle that the whole is greater than the sum of its parts.

4. The NITheCS Organizational Structure

The proposed organisational structure for NITheCS is a consortium-led one, consisting of a hosting (or administrative/lead node) and participating nodes. It has to be noted that the hosting hub has a dual function, namely that of fulfilling administrative and hosting responsibilities as well as having a fully-fledged research and capacity development programme.

4.1 The NITheCS Hub

The purpose of the NITheCS Hub (or hosting/administrative node) is to provide the single contracting link to the DSI and the NRF, and to arrange onward links to the NITheCS Nodes, in terms of invoices, payments and Memoranda of Agreement, as necessary. Hence, the functions performed here will include administration, coordination and management functions including responsibility for auditing, monitoring, and evaluation, legal, contracting and accountability. In the foundational phase of the NITheCS, the Director of the NITheCS will be based at the Node which also performs the function of the Hub, since the Director has fiduciary responsibility. This means that one university will be both the site of the Director and the Hub. The NITheCS Director is regarded as the Principal Investigator (PI) for the NITheCS.

Therefore, it is critically important when submitting the EoI to clearly indicate which institution is considered as hosting[1] a Node or whether the host institution also wants to be considered as the Hub for the NITheCS. Please note that the DSI and NRF do not intend creating a separate site which only functions as a purely administrative Hub with no research activities.

4.2   The NITheCS Nodes

The purpose of a NITheCS Node is to pursue the implementation of the research mandate of the NITheCS, as well as the additional and complementary activities as identified within/between the identified themes, aligned to specific national imperatives.

A NITheCS Node is hosted by a university or institute that is a legal entity and can include a network of universities, research institutes, science councils, national facilities, and the private sector. Establishment of Nodes must be driven by needs and excellence and be informed by current expertise, know-how and infrastructure, human capacity and capability or the high potential that these could be grown in an area over time. This articulation of a NITheCS Node provides the economy of scale that is needed under present fiscal constraints.

Where the NITheCS has reached a level of growth which necessitates expansion of the scope of work and/or where the work of the NITheCS can be enhanced by an institution or expert in the field, a Node can be established. A Node is led by a Node Head, or Programme Principal Investigator (PPI).

The NITheCS Nodes are envisaged to concentrate existing research excellence, capacity and resources to enable researchers to collaborate across disciplines and

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i.   [1] In this document, the terms Host or Hub and Co-Host or Nodes are respectively used interchangeably as the collaborating research institutions will in effect be co-hosting the implementation of the NITheCS.

institutions on long-term projects that are locally relevant and internationally competitive in order to enhance the pursuit of research excellence and capacity development. A Node is built on the recognition that, in today's world, collaboration is the most effective way to generate meaningful knowledge. It is envisioned that the Nodes will perform crucial roles in providing a presence across institutions, creating a physical point of reference and places at which training and engagement take place. Heads of Nodes will be represented on the NITheCS Management Committee.

In formulating the EoI to establish the NITheCS a consortium model must be considered at the national and nodal levels as directed earlier. A good working example of a nodal consortium is provided by the Inter-university Institute for Data-Intensive Astronomy (IDIA), with the South African Astronomical Observatory (SAAO), African Institute for Mathematical Sciences (AIMS), the University of the Western Cape (UWC), the University of Pretoria (UP), the University of Cape Town (UCT) and the DSI, as well as the company SAP[2]. Another example is the National e-Science Postgraduate Teaching and Training Platform, which is a Wits-led (host/administrative hub) consortium with other (than Wits) nodes: University of Pretoria, North West University, University of Limpopo, University of Venda and Sol Plaatje University. This Platform offers a multi-institutional and multi-disciplinary structured masters degree in e-Science.

The DSI and NRF is also cognisant of the fact that existing entities which may be interested in being considered as a Node, has existing resources, including infrastructure, finances, and human resources, as well as functioning management structures and modalities and lastly, a track record of successful implementation aligned to the vision, mission, and focus/foci of the research entity. Hence, the

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[2] SAP SE is a German multinational software corporation based in Walldorf, Baden-Württemberg that develops enterprise software to manage business operations and customer relations.. The company is especially known for its enterprise resource planning (ERP) software.

latter should be sufficiently evidenced in the EoI and how it will be utilised towards the implementation of the Node as part of the NITheCS, as well as any management and implementation misalignment and gaps/challenges which may exist.

The EoI must clearly spell out the strategic objectives of the nodal consortium and its members:

i. Research
   - Generate world-leading new knowledge in fundamental science
   - Provide high-calibre researchers
   - Provide coherence and critical mass for future leading Theoretical and Computational scientists who foster excellence and impact
   - Provide a source of expertise which can feed into broad national scientific policies and goals

ii. Human Capability Development and Training
   - Achieve equitable participation for all communities in SA
   - Establish the pipeline: undergraduate to postgraduate to postdoc and early career researchers
   - Support Historically Disadvantaged Institutions (HDIs) to build critical mass
   - Encourage and assist established researchers (with no NRF-Rating), emerging researchers and Postdoctoral Fellows to obtain NRF-Rating

iii. Engagement
   - Two-way: in-reach and outreach
   - Local, regional, continental, and global interaction
   - Government and the public sector
   - Industry
   - Civil society

- Interaction with students

iv. Strengthen the Basic Sciences in South Africa

v. Address socio-economic development through training, research, and innovation

vi. Support major science programmes

vii. Impact:

- Impacts (sometimes called benefits) tend to occur via uptake and use of an innovation or initiative by independent parties under indirect (or no) influence from the original researcher(s). Impacts can be 'hard' or 'soft' and have intended and unintended consequences.

- Research Impact Pathway to track inputs, activities, outputs and outcomes of an invention or initiative to assess impact beyond scholarly contributions to the academic research field (i.e., benefits to environment, society, economy and culture).

- Impacts can include improvements in environmental health, quality of life, changes in industry or agency philosophy and practice, implementation or improvement in policy, improvements in monitoring and reporting, cost-savings to the economy or industry, generation of a higher quality workforce, job creation, improvements in community knowledge, better inter-personal relationships and collaborations, beneficial transfer and use of knowledge, technologies, methods or resources, and risk-reduction in decision making.

viii. Sustainability

- Sustainability planning is an important step for the Hub and the Nodes as it prepares an organisation to deliver positive outcomes in the absence of primary funding. What are your organization's long-term goal and the processes, resources required to ensure success?

- The most important aspect of sustainability is to diversify the funding base and to develop long term partnerships with funders to support the endeavor. The financial sustainability of the research programme, the

efficiency of funding flows, the changing and diverse funding environment requires careful reflection.

- Programmatic Sustainability, i.e., to continue the organisation's projects and programme in the absence of NRF support.

5. Transformation

In context of the NITheCS, transformation is viewed multi-dimensionally, where transformation means a marked change in form, nature or appearance of what currently exists in various spheres of the structure and implementation modalities of the institute. Hence transformation includes the demographics of the research and student cohorts as well as the transformation of the sector/fields/disciplines relevant to the institute evidenced through innovation.

In the theoretical and computational sciences, gender, race and institutional affiliation are very significant issues, hence transformation is a critical element aligned to the NRF and DSI transformation policies and strategies. The NITheCS structure has been designed with the latter in mind, hence it cannot be emphasized enough that transformation must be built into every structure and aspect of implementation of the NITheCS from the start.

Since the NITheCS is a collaborative distributed structure, diversity and inclusion shall also focus on the inclusion of HDIs at all levels of the NITheCS structures in addition to gender and race equity. Transformation is essential to ensure legitimacy and enable full participation by all potential researchers and to avoid perpetuating past historical imbalances.

In the pursuit of transformation, both the draft transformation framework*, The National Research Foundation (NRF): A Catalyst for Transformation of the National System of Innovation (March 2017)*, the *DSI-NRF Postgraduate Student Funding Policy (10 April 2019), the DSI Transformation Framework (under*

development) and the DHET Collaboration Framework with HDIs should be utilised.

6.   Management and Governance of the NITheCS

The Host (hub) and nodes (co-Hosting Institutions) will be appointed by the NRF to implement the NITheCS Hub or Node, hence the Host and Co-Hosting Institutions shall be accountable to ensure that the Hub and Node/s complies with both fiscal and operational requirements and observe and perform the terms and conditions set out within the contractual agreement.

Appropriate governance and management structures should be established which directs the strategic, scientific and operational mandate of the NITheCS.

7. Funding

The NITheCS will be resourced through a co-funding model, where the DSI-NRF contribution should be regarded as additional funding to the current funding of the existing research platforms. The DSI-NRF funding will be utilised firstly to enable the NITheCS consortium (Hub and Nodes) to establish itself within the NITheCS configuration, whilst secondly leveraging emerging opportunities aligned to Hub's and Nodes's research outputs, collaborations and partnerships towards future sustainability.

The EoI should provide a high-level budget indicating all current income sources, direct and indirect expenditure, as well as the targeted institutional contribution of the partners/collaborators towards the implementation of the NITheCS.

8. Expression of Interest (EoI) Submission and Assessment Process

8.1.   Eligibility

i.   Applications may only be submitted by consortia of NRF-recognised research institutions such as:

  o   South African public universities; and

o South African public research entities including Science Councils, National Research Facilities and Institutes.

ii. The EoI must be led and submitted by the consortium institution intending (as agreed upon by the consortium members) to host the NITheCS Hub.

iii. A consortium must include HDI representation.

iv. DSI and NRF do not intend creating a separate site which only functions exclusively as an administrative Hub with no research programme.

v. The NRF will only consider applications from consortia that meet the criteria as outlined in this document.

vi. The structure of the submitted EoI must follow and align with the logic of the outline of the NITheCS description, requirements and criteria as contained in the EoI call document.

8.2. The contents of the EoI

The EoI must include the following:

i. The spatial footprint of innovative and critical scientific thinking is addressed through the national nature of the NITheCS in which expanding research outputs and transforming the national research institutional landscape is vital. The institute should have the character of an excellence-driven access User Facility, to which any researcher in South Africa can have access solely based on scientific excellence. To reiterate, the policy of expanding research outputs and transforming the research institutional landscape is the foundation for this initiative. Therefore, it is critically important that the EoI must capture and reflect the national character of the NITheCS. As such, EoIs that are regionally or provincially focused and/or parochially oriented will not be considered by the evaluation panel.

ii. As the NITheCS is intended to be operating at the national level as an institute and will bring together existing relevant research entities, the application must be based on a consortium model of which there must be a demonstrated involvement of Historically Disadvantaged Institutions (HDIs).

iii.   A formal motivation and commitment by the institution intending to host the contracting and administrative Hub for the NITheCS, as well as same from each of the research entities intending to form part of the consortium (Nodes) and of which the latter provides evidence of the readiness and commitment of the institutions to provide an enabling environment to ensure the success of the NITheCS.

iv.   Strengths, capabilities, strategic environment, and competencies of the institution/s involved and must demonstrate alignment with the NITheCS's requirements.

v.   Alignment of the NITheCS's research entities with their respective institutions research strategy and Programme and Qualification Mix (PQM) of the affiliated university where Masters and PhD students will be registered.

vi.   Alignment of the proposed Hub and Nodes with the Vision, Mission and thematic area/s of the NITheCS and clearly demonstrated multi-, inter- and transdisciplinarity;

vii.   The application should contain an expression of the long-term strategy both in respect of the thematic area/s as well as for the sustainability of the NITheCS. A brief anticipated programme of work in terms of research, training, and engagement, conducted by each of the research entities (Nodes) should be provided.

viii. The research focus must have associated research questions, an indication of how it interfaces with existing structures and institutions and it is a focus of effort and investment by the university or Institute. It may involve both internal capabilities and external collaborators. It is recognised that the themes are fundamentally different and have different mechanisms for delivery of impact. This notwithstanding, mechanisms for the management of each focus or theme are required in the proposal.

ix.   The consortium EoI submission must clearly indicate a highly focused and coherent research, training and engagement programme that is strongly underpinned by the theoretical and computational science (i.e., theoretical

physics, mathematics, statistics, astronomy and astrophysics, data science, quantitative finance, quantitative biology and bioinformatics, and climate and earth systems modelling).

x.   The envisaged governance and management modalities must be clearly articulated in particular the reporting lines and location of the NITheCS within the institutional structure.

xi.   Evidence must be provided of existing and potential future collaboration with South African, regional, continental (Africa) and international networks in the relevant fields, as well as public sector, private sector and civil society organisations.

xii.   All aspects of planned activities must include indicative key performance indicators, targets, knowledge outputs[3], human capability outputs[4] and outcomes, impact[5] and timelines.

xiii.   The potential of the proposed NITheCS to enhance the international research and/or innovation competitiveness within the discipline;

xiv.   The potential of the research to impact on transformation, the social and/or economic development of the country;

xv.   The EoI should contain an indication of how the proposed NITheCS intends to achieve sustainability, with due consideration of succession planning, the leveraging of funds and a vision for their future beyond DSI-NRF contract funding.

xvi.   An indicative budget must be provided containing all income sources and the key cost drivers for the implementation of the NITheCS.

xvii.   The EoI must contain the nomination for the position of the Node Head at each of the respective research entities forming part of the consortium.

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[3] Peer-reviewed journal articles, peer-reviewed conference proceedings, scholarly books and book chapters, patents, invited keynote presentations, conference presentations etc.
[4] Numbers of Masters, and Doctoral graduates and completed postdoctoral fellowships.
[5] *A beneficial change in society or knowledge advancement, brought about as a direct or indirect result of the NRF's research support interventions, whether planned or unintended, immediate, or longer-term.* (NRF Framework to Advance the Societal and Knowledge Impact of Research. Version: 5 March 2021)

8.3. Submission process

i. The Expression of Interest (EoI) Call will be open from **20 May 2022 to 17 June 2022**, with the **10 June 2022 being the closing date for submission to DAs** and the submission date to the NRF being 17 June 2022.

ii. The EoI must be completed by the lead institution in consultation with all consortium members and submitted to the lead (Hub) institution's Designated Authority (DA) and accompanied by letters of support by the DAs of all other consortium members.

iii. The DA must submit the validated applications as PDF via email to the NRF and specifically to Mrs Judith Mahlanya (Professional Officer: Grants Management and Systems Administration) and Mr Simon Lotz (Director: Grants Management and Systems Administration) at the following email addresses; JK.Mahlanya@risa.nrf.ac.za and SM.Lotz@risa.nrf.ac.za.

iv. Late applications received after the closing date, as stipulated in the Call document, will not be accepted, nor considered.

v. The NRF will not process EoIs that are (a) incomplete, (b) contain insufficient or incorrect detail, (c) that do not meet the eligibility criteria and call requirements hence such applications will be rejected.

8.4. Assessment process

The EoIs will be assessed by an evaluation panel convened by the NRF aligned to the criteria as captured in this call document and subsequently ranked. The NRF and the DSI will then discuss the recommendations of the evaluation panel and reach consensus on which consortia-led EoIs to invite to submit Full Proposals through a closed, targeted call. Consortia that do not submit EoIs will not be eligible for submission of Full Proposals since the Call for Proposals will be a closed call targeted only at consortia that have submitted EoIs which have been positively reviewed by the NRF convened evaluation panel.

All applicants who submit EoIs will be provided with feedback on their submissions.

9. NRF Contact Persons

For Application and grants management related inquires please contact:

- Mr. Simon Lotz, Director: Grants Management and Systems Administration, e-mail: SM.Lotz@risa.nrf.ac.za

- Mrs. Judith Mahlanya, Professional Officer: Grants Management and Systems Administration, e-mail: JM.Mahlanya@risa.nrf.ac.za)

For Reviews and Evaluations related inquires please contact:

- Dr Patrick Nonjola, Director: Reviews and Evaluation, email: ptn.nonjola@risa.nrf.ac.za
- Mr Mashudu Mbulaheni, Professional Officer: Reviews and Evaluations, email: m.mbulaheni@risa.nrf.ac.za

For information regarding the NITheCS Funding Instrument:

- Mr Nathan Sassman. Director: CoEs, NRF (Email: NE.Sassman@risa.nrf.ac.za)

ANNEXURE A – The NITheCS Roadmap