



BRICS STI Framework Programme 5th coordinated call for BRICS multilateral projects 2021

Call is open until 14th October 2021, 15:00 Moscow Time (UTC+3)

I. General Description

I-1. Joint Funding of Multilateral Research Cooperation

The BRICS STI Framework Programme aims to support excellent research on priority areas which can best be addressed by a multinational approach. The initiative should facilitate cooperation among the researchers and institutions in the consortia which consist of partners from at least three of the BRICS countries.

As part of the initiative the following research funding organizations from the BRICS countries have agreed to jointly establish a new scheme for funding multilateral cooperative activities:

Brazil:

National Council for Scientific and Technological Development (CNPq)

Russia:

Foundation for Assistance to Small Innovative Enterprises (FASIE)

Ministry of Science and Higher Education (MSHE)

India:

Department of Biotechnology (DBT)

Department of Science and Technology (DST)

2) technical solutions to the associated enormous Big Data and Big Compute challenges arising from such worldwide networks of transient detectors and imaging surveys, including the Square Kilometre Array (SKA) and the Rubin Observatory's Legacy Survey of Space and Time (LSST), leading global projects in which many BRICS countries are actively involved.

Thanks to their unique, worldwide geographical distribution, BRICS countries are well placed to take the global lead in this quickly evolving and compelling research area, utilizing both existing and future telescopes within BRICS. The latter includes an ambitious plan for a global network of optical telescopes with the unprecedented ability to observe the entire sky continuously on a timescale of less than an hour, greatly increasing our ability to monitor the changing cosmos. New science would not happen without innovation in both instruments and big data science methods and systems, and this project will therefore bring together teams within BRICS to lead programmes in data innovation in each partner country. The collaboration will include academia and industry from partner countries and will focus on developing technologies of the 4th industrial revolution. An essential human capital development programme is designed to create a new generation of data-savvy scientists and engineers within BRICS, strengthening the scientific community in the global South. Cross disciplinary and links with industry will be a key focus of this project, accelerating technological spin offs and working actively to promote science for development. The depth and breadth of this network, embedded through this project, will benefit the BRICS participants beyond what we could achieve as individual countries. The nature of this thematic area is such that it creates the potential to stimulate conversations across disciplines to tackle current global challenges such as COVID-19, using data skills, training and infrastructure.

2. Antimicrobial resistance: technologies for diagnosis and treatment;

The World Health Organisation (WHO) has declared Antimicrobial Resistance (AMR) as one of the top 10 global public health threats facing humanity (www.who.int). BRICS countries have acknowledged that this health issue could undermine decades of progress in combating infectious diseases and emphasized the need to implement the WHO's Global Action Plan on AMR addressing issues of equity, affordability and sustainable access to medicines. The Global Plan calls for greater innovation and investment in operational research, and in R&D of new antimicrobial medicines, vaccines, and diagnostic tools especially in accordance with what was pointed out by WHO in "Prioritization of Pathogens to Guide Discovery, Research and Development of New Antibiotics for Drug-resistant Bacterial Infections, including Tuberculosis".

a. Diagnostic tools: Design, development and validation of rapid and early diagnostic tests, including point-of-care tests for the treatment and prevention of infections, particularly those caused by antibiotic resistant organisms in humans.

b. Therapeutics: To improve existing antimicrobial treatment by augmenting discovery of novel drugs, treatment strategies and alternative therapeutics and optimizing drug use, dose and delivery. This would include:

- Development of new novel antimicrobial drugs (involving synthetic biology/chemistry or alternatives to antibiotics) or investigation on new potential targets for the development of antimicrobial drugs (bacteria, parasites, viruses and fungi).
- Develop treatment protocols based on combination therapy using existing and new antibiotics
- Address gap in our understanding of the molecular and cellular biology of bacteria, parasites, viruses and fungi resistance, especially how they evolve, acquire and transmit antibiotic resistance and how they adapt to life in humans.

c. Vaccines: Develop vaccines to be used prophylactically, decreasing the number of infectious disease cases, and thus antibiotic use and the emergence and spread of AMR.

3. Simulation and big data analytics for advanced precision medicine and public healthcare;

Big Data are radically changing biomedical research. The unprecedented advances in automated collection of large-scale molecular and clinical data pose major challenges to data analysis and interpretation, calling for the development of new computational approaches. The creation of powerful High Performance Computing (HPC) systems for the effective use of biomedical Big Data in Personalized Medicine (a.k.a. Precision Medicine) will require significant scientific and technical developments, including infrastructure, engineering, project and financial management. We review here how the evolution of data-driven methods offers the possibility to address many of these problems, guiding the formulation of hypotheses on systems functioning and the generation of mechanistic models, and facilitating the design of clinical procedures in Personalized Medicine. Some of the areas include HPC, wearable device technologies, computational genomics, AI, modelling, simulation and big data analytics for advanced precision medicine and public healthcare, with applications including Genomics and epidemiological surveillance, drug design, vaccine design.

4. High Performance Computing (HPC) and BigData for Sustainable Development: Solving Large Scale Ecological, Climate and Pollution problems;

Numerical weather prediction (NWP) and Earth System modelling (ESM) have been for decades among the most challenging tasks for high-performance computing owing to the dramatic range of temporal and spatial scales to be resolved and complexity of processes being simulated. Currently, the progress of weather, climate and ecological services as well as related academic studies critically depend on their performance on existing and prospective HPC systems. The newly developed numerical methods as well as elaboration of existing code have to target the usage of hybrid HPC architectures. New approaches to environmental prediction based on artificial intelligence (highly efficient on modern GPUs) and novel methods to tackle BigData processing demonstrate excellent results in a number of environmental problems. The latter includes AI spatio-temporal models for natural phenomenon prediction, as well as the promising fusion of AI models with more conventional hydrodynamic models of atmosphere and ocean dynamics.

The objective of this call is to support advances in development of cutting-edge applications of HPC code for the solution of ecological, climate and pollution problems, important for BRICS countries, covering a wide range of aspects from mathematical basis of HPC algorithms, and new AI-based approaches leveraging weather forecast, to efficient use of HPC and BigData in particular weather and environmental prediction tasks and estimating related socio-economic impacts. The proposals covering both fundamental research topics and real-life applications are highly encouraged. The prioritized topics include:

- development of prospective numerical methods, algorithms, parameterizations and tools for solution of large-scale direct and inverse problems of environmental prediction on hybrid HPC systems;
- advances in high-resolution Earth System modelling and implications for socio-economic strategies;
- diagnostics and prediction of extreme weather phenomena and flooding/drought events using HPC and AI;
- HPC, BigData and AI for sustainable development of urban environment: solving ecological, climate and pollution problems of megacities;
- HPC and geospatial data processing for environmental applications.

5. Innovation and entrepreneurship on Photonic, Nanophotonics and metamaterials for addressing bio-medicine, agriculture, food industry and energy harvesting issues;

This thematic area aims to create, integrate and strengthen International Cooperation

projects within the BRICS in the fields of Photonics, Nanophotonics and metamaterials. It seeks to promote the generation of knowledge, guided by the needs of the private sector, for the development of processes, products and instrumentation, as well as stimulating integration, the exchange of knowledge, strategic alliances and the exploitation of synergies between the BRICS countries for the development of technologies. In addition, it is expected to foster innovation, entrepreneurship, and integration between ecosystems. In order to be considered eligible, projects must address the interfaces between Photonic, Nanophotonics and metamaterials for the areas of bio-medicine, agriculture, food industry and energy harvesting issues.

6. Materials science and nanotechnology for addressing environmental, climate change, agricultural, food and energy issues;

At present, one of the dominant trends recognized by the world community is the achievement of sustainable development, including the use of natural resources and the direction of scientific and technological development that would strengthen the current and future capacity to meet human needs and aspirations. At the same time, in many respects we are speaking about ensuring the quality of life of people. The basis for the development of technologies in this direction is research and creation of new advanced materials that could form the basis of a new economy that can fulfill the objectives of sustainable development. Applications in response to the call may be submitted for any types of materials and nanotechnologies, including advanced magnetic and ferroelectric materials, that develop world science and technology in the direction of mitigating climate change and preserving the environment, optimizing the carbon balance, preventing climate disasters, developing safe agricultural products and food, developing carbon-free (low-carbon) energy and transport.

7. Renewable energy, including smart grid integration;

The 21st Century human life depends entirely on energy on a day-to-day basis. From waking up to an alarm on a smartphone to sleeping in an air-conditioned room, one cannot live without electricity. The world has not yet found sustainable ways to conserve this energy for future generations. The conventional ways of producing energy have proved to be exceedingly harmful to the earth and have rapidly aggravated the pace of global warming, leading to climate change and other climate-related problems. It is the need of the hour to decarbonize and conduct research to find adaptable, convenient, sustainable, and cheap means to produce energy. Suggested topics:

Renewable energy

According to IEAS, renewable energy makes up 26 per cent of the world's electricity today. It includes solar, wind, hydel, tidal, geothermal, and biomass. The challenge is to make optimum use of renewable energy, cost effective, storage and efficient distribution. Advanced Hydrogen and Fuel cell promoting and supporting activities related to indigenous development of new and existing material in large quantities, catalysts, membrane, components for fuel cells, electrolysers, hydrogen storage materials, materials for type IV cylinders and prototypes for implementation of various applications of hydrogen and fuel cell in the BRICS country.

Battery technologies

The battery technology development has been varying from stagnant periods to significant breakthroughs, in an almost unpredictable fashion. The trend has been consistently directing away from heavy and acid batteries to compact, light and far more efficient nickel/metal (NiMH) accumulators.

Grid technologies

Grids help in facilitating efficient and reliable end-to-end intelligence for a two-way delivery of energy from source to consumers through the integration of renewable sources. *Smart grid* technologies empowered by digital twin concepts bring predictability, efficiency and sustainability which entail the growth of electricity demand which further helps in monitoring and control of electric power systems, power quality management, security and privacy, digitalization and smart home energy system.

8. Ocean and polar science and technology;

With ever increasing importance of the ocean and polar regions, BRICS countries, which are washed by every ocean of the World, are deeply engaged in developing ocean and polar science and technology. Nowadays, the ocean and polar systems are subject to climate change effects and increasing anthropogenic pressures. The latter include not only em

Sustainable Development and the UN SDG 14 (Life below water) represents a great opportunity for a deepening cooperation among BRICS in these fields.

Based on the aforementioned general considerations, the applicants are invited to address the following topics:

- i. Operational oceanography including observations, model forecasts, and data assimilation in numerical models;
- ii. Marine pollution, disaster prevention, mitigation, restoration and blue carbon;
- iii. Deep-sea research including cold and thermal seeps, hydrothermal vents and seamounts;
- iv. Extreme environment research – permafrost, anoxia, hyperhaline water bodies, etc.;
- v. Impacts of climate variability and climate change on polar environment and the teleconnections with tropical areas;
- vi. Coastal and shelf processes and ocean-land interactions;
- vii. Structure and physical properties of sea ice in observations and models;
- viii. Polar research, including paleoceanography, sea ice dynamics and ecosystem evolution;
- ix. Marine biotechnology.

9. Water treatment technology;

Water resources are necessary for sustaining human life and life of other living organisms, assuring manufacturing and agriculture. However, anthropogenic factors, natural geochemical and biological processes, climate change processes lead to disruptions of water ecosystems, worsening water quality and decreasing volumes of fresh water.

Access to fresh water is limited for certain categories of users, and, this represents one of the major global challenges due to increasing water consumption, low levels of water resources replenishment and the impact of external factors. High quality water reserves are shrinking, and this limits opportunities for preserving public health, biodiversity, nature's aesthetic and recreational potential. Water scarcity directly affects over 40% of the world population in water stressed regions of every continent. It also has severe repercussions for the neighboring countries and represent a growing global problem for humanity. The United Nations project that by 2050 one in four people or more will be affected by repeated water shortages. BRICS countries already face this problem either in a national or regional perspective.

Integrated (sustainable) water resources management and pollution treatment should be applied in order to address the global water challenges. This priority (thematic) area

addresses research applications in two thematic fields: water resources management and water pollution treatment. The topics of the call are based on the United Nations Sustainable Development Goals, specifically the targets of the Goal 6: Clean water and sanitation.

Integrated water resources management: sustainable water resources management and governance, including efficient water use, water conservation, transboundary water relations and water diplomacy; assuring access to clean water for all; assuring access to adequate and equitable sanitation and hygiene for all; evaporation control technologies; new approaches, methods and instruments for analysis of existing knowledge on temporary and spatial changes in flood patterns in various regions; monitoring and prevention of water-related disasters; sustainable management of water ecosystems; ICT and big data tools for water resource management and governance; testing and distribution of cheap water desalination technologies; promoting efficient food-water-energy nexus technologies; improving water and sanitation management at local level.

Water pollution treatment: comprehensive assessing negative impact on water quality in natural water bodies; industrial and agricultural wastewater pollution treatment, providing adequate water quality and quantity; innovative technologies of domestic (household) water and wastewater treatment, storm and urban runoff treatment; economically viable use of chlorine-free water treatment technologies and nanotechnology for pollution control and desalination; drinking water treatment for emerging pollutants; multi-purpose water reuse and recycle technologies; control of marine pollution including oil-spills, marine litter, ballast water treatment and seaport waste treatment systems.

10. Research in aeronautics and aerospace;

Aeronautics has always been at the forefront of the development of science and technology. Its technologies are catalysts for innovation and promote the development of other economic and technological sectors, contributing to the growth of national economy as a whole. BRICS countries have good cooperation foundation. Jointly innovative research can accelerate technology development, promoting the all-round development of regional aeronautical cooperation among BRICS countries and achieving mutual benefit and win-win results. The objective of this call is to support advances in aeronautical technology research and development. The prioritized topics include:

Modern aviation aircraft research. To establish highly-accurate numerical method and wind tunnel test verification technology, to develop aerodynamic design technology for modern aviation aircraft, such as short take-off and landing transport aircraft with powered lift

system.

Composite damage behaviour research. To establish a high-resolution ultrasonic detecting method and device for defect and damaging behaviour of composites, to get mechanical behaviour and failure mechanism, material development and process optimization, structural safety and life evaluation of composites in aviation and other fields.

Please note that the thematic areas and type of supported research vary depending on the particular participating funding organization. More details can be found in respecting National Annex document (available on <http://brics-sti.org/index.php?p=new/30>) or from national contact points. However, the general information on thematic areas supported by each of the participating funding organization is presented below:

	<i>Thematic areas</i>	Brazil	Russia		India		China		South Africa
		CNPq	FASIE	MSHE	DBT	DST	MOST	NSFC	V
1	Transient astronomical events and Deep Survey science	V	V	V		V		V	NRF
2	Antimicrobial resistance: technologies for diagnosis and treatment	V	V	V	V	V	V		SAMRC
3	Simulation and big data analytics for advanced precision medicine and public healthcare	V	V	V	V	V		V	SAMRC
4	HPC and BigData for Sustainable Development: Solving Large Scale Ecological, Climate and Pollution problems	V	V	V	V	V	V		NRF
5	Innovation and entrepreneurship on Photonic, Nanophotonics and metamaterials for addressing bio-medicine, agriculture, food industry and energy harvesting issues	V	V	V		V	V		TIA
6	Materials science and nanotechnology for addressing environmental, climate change, agricultural, food and energy issues	V	V	V	V	V		V	NRF

7	Renewable energy, including smart grid integration	V	V	V		V		V	NRF
8	Ocean and polar science and technology	V	V	V		V	V		NRF
9	Water treatment technology	V	V	V		V		V	WRC
10	Research in aeronautics and aerospace	V	V	V		V	V		DSI

I-2. Invitation for Proposals and Prospective Applicants

The BRICS STI FP participating funding organizations shall invite applicants from their countries to identify potential partners in at least two other BRICS countries and to jointly prepare proposals for collaborative R&D projects in the ten thematic areas of the call.

All applicants must fulfil their respective national eligibility rules for research grant applications (please refer to the National Annex document and consult with national research funding organization participating in the call).

I-3. Financial Support

The participating funding organizations plan to support collaborative activities including exchange of researchers from the participating counterpart countries. Conditions of support will vary by country and respective national funding organizations' approaches with a common rule that each participating funding organization funds its national researchers or institutions.

The duration of a collaborative research project will be two or three years with expected start date of projects around the middle of 2022.

II. Application

A joint project will comprise of at least one Principal Investigator (PI) from each of the participating countries (please also refer to national annexes for additional requirements), with one of the project participants also acting as a Project Coordinator (or lead PI). Project consortia should consist of applying for funding partners from at least three of the BRICS countries.

The application submission is a two stage process:

Stage 1: Pre-proposal

A **Joint Application Form (JAF)** (link for download: http://brics-sti.org/files/JAF_BRICS_Call_2021.docx) shall first be submitted by the Project Coordinator to the Call Secretariat through the online **BRICS STI Framework Programme Application Management System (BRICS AMS)** at <http://ams.rfbr.ru/BRICS>. JAF must be completed in English.

The Joint Application Form solicits information on:

- 1) Thematic area;
- 2) Title and acronym of collaborative research project;
- 3) Proposed period of collaborative research project;
- 4) Project summary;
- 5) Project objectives;
- 5) Research teams;
- 6) Budget requested.

Stage 2: Full Proposal

Invited projects' consortia shall submit national components serving as a Full Proposal to their respective national funding organizations. Each national team of a project **shall submit a national component** (i.e. proposal) to the relevant national participating funding organization in accordance with all required procedures of each particular participating funding organization.

The national component to be submitted varies in form, terms and information provided depending on the particular participating funding organization. More details can be found in the National Annex document (can be downloaded from <http://brics-sti.org/index.php?p=new/30> page) and on the websites of participating funding organizations.

A project consortia which does not submit by due date a fully completed Joint Application Form to the Call Secretariat through the Application Management System (www.ams.rfbr.ru) or national components to all respecting national funding organizations will automatically be considered as ineligible.

II-

Following Pre-proposal review, applicants will be notified of the outcomes of the review by Call Secretariat. The results of the review for each Pre-proposals will be communicated via BRICS AMS system by changing the status of the respective Pre-proposal to “invited” or “not invited”. Upon changing the status of Pre-proposal in the BRICS AMS system an additional e-mail notification may be sent to the respective project coordinator, however, applicants are obliged to monitor the status of the project by themselves and e-mail notification should be treated only as an additional action (failure of e-mail receipt may not serve as excuse for not being notified).

It is expected that Pre-proposals review outcomes will be communicated to applicants in late December 2021.

Stage 2: Submission of Full Proposals (national components).

Each national team of a project invited to Full proposal stage should submit a national component to the respective national funding organization according to its own rules and procedures. If any of the PI of the particular project consortia fails to submit a national component to respective national funding organization, the Full proposal will be considered as not submitted. The national component to be submitted varies in form, terms and information provided depending on the particular participating funding organization. More details can be found in the National Annex document (can be downloaded from <http://brics-sti.org/index.php?p=new/30> page) and on the websites of participating funding organizations.

Please note that some participating funding agencies may start the process of national component submission prior to the Pre-proposal review completion. In this case certain national teams applying for funding to their respective national funding organizations may need to enter the Full Proposals submission stage (submit national component) prior to receiving information on results for respective Pre-proposal review.

II-4. Receipt of Application Forms by Call Secretariat

Following the online submission of the Joint Application Form, the confirmation message with Pre-proposal registration number will be shown in confirmation message. On “my projects” page in BRICS AMS the proposal status thereafter will be shown with assigned registration number BRICS2021-XXX (where XXX stands for unique number) and stage “Registered”.

II-5. Retraction of submitted Pre-proposal application

At any time after online submission of a Pre-proposal application before the

Full-Proposals:

The following general evaluation criteria will be considered (please also refer to national call announcements information on national component):

- Scientific quality and innovation of the joint research plan
- Sound project management, methodological approach, feasibility and appropriateness of the joint research plan
- Added value to be expected from the research collaboration
- Balanced cooperation
- Competence and expertise of teams and complementarities of consortium (interdisciplinary / all necessary expertise)
- Appropriateness of resources and funding requested
- Expected impacts: e.g. scientific, technological, economic, societal
- Opportunities for early career researchers
- To encourage the participation and joint research by the business sector.

III-3. Announcement of Decision

Applicants will be notified of the final decision in the second quarter of 2022 regarding the approved joint projects for funding.

IV. Responsibilities of the PI following approval of projects

After the proposals have been approved, the PI and his/her own affiliated institution are required to adhere to the following when carrying out the collaborative research and utilising funding:

IV-1. Progress Report

Progress Report to each participating funding organization

All researchers must follow their own funding organizations' rules and procedures.

IV-2. Final Report

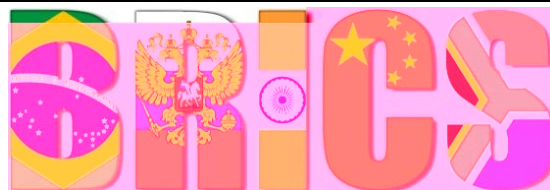
IV-2.1 Final Report to the BRICS STI Framework Programme Secretariat

After completion of the period of joint research, the project coordinator shall complete and submit within three months an integrated final report to the BRICS STI FP Secretariat on

the results of the joint research. The report will be reviewed by the BRICS STI Funding Working Group.

IV-2.2 Final Report to each participating funding organization

All researchers must follow their own funding organizations' rules and procedures.



BRICS STI Framework Programme – Joint Call Secretariat

<http://brics-sti.org/>

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V. National Contact Points

Applicants should contact the following national contact points for information on each Party's national eligibility rules or support conditions:

Brazil:

National Council for Scientific and Technological Development (CNPq)



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General Coordinator of International Cooperation
National Council for Scientific and Technological
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Russia:

Foundation for Assistance to Small Innovative Enterprises (FASIE)



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