BRICS STI Framework Programme
Coordinated call for BRICS multilateral projects – Pilot call 2016

Call is open until 25th August 2016, 17:00 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 Education and Science (MON)
Russian Foundation for Basic Research (RFBR)

India:
Department of Science and Technology (DST)

China:
Ministry of Science and Technology (MOST)
National Natural Science Foundation of China (NSFC)

South Africa:
Department of Science and Technology (DST)
National Research Foundation (NRF)

I-2. Aim of the Joint Call and Thematic areas

Collaborative multilateral basic, applied and innovation research projects in the following thematic areas can be submitted in response to the call:

(a) Prevention and monitoring of natural disasters

Human factors such as globalization, population growth, poverty, urbanization and changes in land use are aggravating the negative consequences of natural hazards. Earthquakes and more frequent and intense extreme weather and climate events are also increasing the risks faced by populations living in vulnerable areas. The losses are increasing in BRICS countries. Repeated exposure to disasters is hampering sustainable development in vulnerable localities. Although we have increased scientific knowledge and technology, we have not yet been successful in anticipating and effectively coping with unprecedented natural hazards. We need to identify potential risks, evaluate system vulnerabilities, take action from lessons learnt from past experiences and improve emergency preparedness and capacities to manage crises. At present, international collaboration in disaster risk reduction is not sufficient.

To reconcile the relationships between development, environmental issues, and improved resilience to disasters, important global decisions were made and came to fruition in 2015, with the Sendai Framework for Disaster Risk Reduction (SFDRR) in March. To end poverty and hunger and make human settlement inclusive, safe, resilient and sustainable, it is essential to strengthen capacity for adaptation to climate change and holistic disaster risk management at all levels. It is first of all important to identify, visualize, and evaluate under-recognized disaster risks that hinder sustainable development by taking a holistic view of the changes in hazards, vulnerabilities and exposures arising from societal and environmental problems. Metrics and indicators should be developed for evaluating vulnerability and resilience. Then, effective measures should be taken to anticipate, prepare for, and reduce the consequent disaster risks. It is equally essential to be able to develop response and recovery countermeasures even in the face of disasters and to build capabilities to make proper decisions for action in a timely manner to protect lives, livelihoods, and communities in order to fully recover from the impact of a disaster. Thus, it is critical to construct societies resilient to disasters by improving understanding of natural and human-made hazards, by developing new technologies for disaster prevention, by constantly raising political and public awareness and by preparing for effective emergency response -

including mental and physical health management - and recovery under the concept of "Build Back Better."

To build such resilient societies, scientists and engineers should develop and practice concrete steps to make full use of science and technology with the following two perspectives. The first perspective concerns the promotion of inter-disciplinary research between natural/applied sciences and humanities/social sciences, the former specializing in understanding disaster occurrence mechanisms and design/maintenance of infrastructure and its functions, and the latter in evaluating disaster impact on socio-economic activities and analyzing human perceptions from the viewpoint of behavioral science. The integration of these two domains should be proactively pursued to enhance the disaster reduction capabilities of humankind. The second perspective concerns the promotion of trans-disciplinary cooperation, which enables the social implementation of science and technology for disaster risk reduction, through effective collaboration with Future Earth, to secure sustainable development. Efforts should be made to develop and strengthen a national platform for disaster risk reduction where scientists and practitioners in each country can work closely together with all relevant stakeholders based on discussions on the actual situations faced by their respective countries in their mother tongues

The priority (thematic) areas addressed in this call for proposals in the BRICS is as follow:

1. Understanding Disaster Risk.

It is critically important to make unflinching efforts for understanding hazards expected to happen and for reducing vulnerability of our infrastructure and society. To make the efforts bear fruit, each country should be supported in

- Collecting and archiving hazard event records and characterizing them with relevant information on land use and socio-economic activities
- Producing wide-area hazards and its impact data and information with the utilization of satellite observation and numerical modeling
- Producing reliable disaster statistics will be conductive to allowing each country to make well-informed decision making for disaster risk reduction.
- Improving assessment of disaster risks, monitoring and prediction of changes in disaster risks levels,
- Conducting data integration, analysis and visualization supporting a holistic understanding of disaster processes and consequences.

2. Strengthening Disaster Risk Governance to Manage Disaster Risk.

in order to Strengthen Disaster Risk Governance, Initiatives should provide support in

- How society may curb the increase in disaster vulnerability arising from misguided development activities in land use, construction of infrastructure and housing.
- How individuals, communities and authorities may behave appropriately and be better informed before and during emergencies for protecting their lives, livelihoods and health.

Meanwhile, It is urgent to strengthen international cooperation in the development of monitoring, systems (in situ and from satellite technology), early warning networks and enhanced emergency cooperation during disasters, such as the International Disaster Charter by space agencies. BRICS should also

- Support initiating a forum to discuss practical solutions to reduce disaster risks in line with the Sendai Framework, with all types of stakeholders from all over the world.

(b) Water resources and pollution treatment

Sustainable Water Resources Management and Pollution Treatment is a response to one of the most important global challenges for growing water stress and water crisis (in several regions).

This priority (thematic) area addresses research applications in two major thematic fields: Water Resources Management; Water Pollution Treatment.

Water Resources Management includes STI, inter alia: sustainable water resources management and governance, including water withdrawal reduction, water conservation by largest consumers, and transboundary pollution prevention and reduction; securing drinking water, sanitation and hygiene (WASH), prevention of for all water-related diseases; evaporation control technologies; monitoring an prevention of water- related disasters; sustainable management of water ecosystems; ICT for water resource management and governance; desalination in large volumes.

Water Pollution Treatment includes STI, inter alia: industrial and agricultural wastewater pollution treatment, providing adequate water quality and quantity; domestic wastewater, storm and urban runoff treatment; economically viable use of chlorine-free water treatment technologies and nanotechnology for pollution control and desalination; reuse and recycling of water as a resource; control of marine pollution including oil-spills, marine litter, ballast water treatment and seaport waste treatment systems.

(c) Geospatial technology and its applications

Globally, Geospatial Technology has made inroads into various sectors of development cutting across public, private and non-profit domains. In order to cater to the growing demand of Geospatial Information, Tools/ Technologies, and Skills in their respective economies, the BRICS Nations have been investing in developing reliable geospatial information infrastructures and putting in place appropriate policies.

In the above backdrop, the First Call for Proposal intends to promote Geospatial Research, Technology Development and Applications at national, regional and global levels for Good Governance and Decision-making. This is proposed to be achieved through joint programmes and projects by harnessing the core competencies of the Academia; Research Institutions; Government Agencies and Industries of the BRICS Countries. In the long run, it is envisaged to establish a Joint BRICS Geospatial Research Centre that could harness the potential of Geospatial Technology in providing good governance Services and improved systems for decision-making.

The following six priority areas have thus been identified through deliberations/ consultations amongst the Geospatial Technology representatives from the BRICS Countries.

• Geosciences collaboration (Geodesy): Research collaborations in the domains of Mathematical Geodesy and Physical Geodesy, The Global Space-ground Integrated Geodetic Reference Frame Construction, Satellite Gravity Data Processing and its Application, Development of Prospective Technologies in Geodesy, Applications of GNSS to Studies in Geodesy, Navigation, Earth Deformations; Modern techniques for Geodetic Network Analyses etc.

• Remote Sensing data processing for People-centric Applications: With the launching of indigenous remote sensing satellites and availability of various other earth observation tools/ technologies, BRICS Nations are now equipped to utilize the data generated by these satellites for various development oriented applications. This provides foundation to build a global radiation and geometric calibration and validation network for remote sensing data and geospatial products through making full use of the diversification in terrain surface, sun lighting, atmosphere and background climate conditions within BRICS. Proposals are invited in (though not restricted to) areas like Earth Observation Data and Geospatial Information Products Joint Calibration and Verification, Remote Sensing Data Processing and Typical Features Dynamic Monitoring for Applications in Agriculture, Ecology, Infrastructure Management, Land Use Land Cover Study, Water Resources and Development of Smart Cities.

• Policy and Data Availability: Policies, technologies and infrastructure on delivering data, information and knowledge are critical to informed decision making. Proposals are thus invited on The Establishment Of Regional Remote Sensing Information Products Sharing Platform, The Development of the Regional Mechanism of Geospatial Information Resources Integration and The Global Standardization Of Geospatial Products, Utilization of Open Geospatial Data amongst the BRICS Nations that may in the long run lead to the development of the BRICS Geospatial Data Portal useful to the promotion of common global and domestic interests for people-centric development and the application of remote sensing information products within BRICS.

(d) New and renewable energy, and energy efficiency

To encourage research institutions, enterprises, universities and other relevant entities from BRICS countries to jointly develop collaboration and demonstration projects on new and renewable energy, energy saving, and energy efficiency. The priority topics for this first call are:

New and Renewable Energy: Photovoltaic Power Generation and System Application Technology; High Quality Biomass Energy Utilization Technology; New Technology for Energy Storage.

Energy Efficiency: Development of Accelerated Life Cycle Models for LED Lamps; Development of Solar Powered LED Lighting Systems with Distributed Batteries; Research on the key technologies of coal to clean gaseous fuel and its environmental protection to realize clean and efficient coal utilization.

(e) Astronomy

The BRICS member countries have strong traditions of excellence in astronomy with many of their scientists making outstanding contributions in this field of human endeavour. All without exception are playing a leading role in the development and exploitation of various international astronomy projects. South Africa is a leading partner in the international consortium on the Square Kilometre Array (SKA). China is building the Five-hundred Metre Aperture Spherical *Telescope (*FAST) radio telescope and India's *Giant Metre wave Radio Telescope* (GMRT) is considered the world's largest metre wave radio telescope. Similarly China's Large Sky Area Multi-Object Fibre Spectroscopic Telescope (LAMOST) and Russia's super-VLBI RadioASTRON are providing ground breaking leadership in global space astronomy programmes. Brazil also participates in a number of important international collaborations, including the construction and operation of the Gemini and Southern Astrophysical Research Telescope (SOAR) optical and infrared telescopes in Chile, the Pierre Auger cosmic ray observatory and the Solar Submillimetric Telescope in Argentina, the Convection, Rotation and planetary Transits (CoRoT) space mission, and the Brazilian Decimetric Array.

The geographical distribution of BRICS countries around the globe covering northern, southern, eastern and western hemispheres also creates unique opportunities for time domain astronomy in single wavelength and multi-wavelength regimes. Their complementary strengths in terms of geographical advantages for hosting astronomical facilities, strategic infrastructures, scientific and technical strengths, expertise in instrumentation development, theoretical and computational excellence, industrial capabilities, and education and training opportunities provide BRICS member countries with unique capacities that should be harnessed to further expand their leading role in world astronomy. All these factors as well as the vision formulated at the First BRICS Working Group on Astronomy (WGA) underscore the importance of astronomy cooperation within the framework of BRICS. The BRICS countries recognise that:

1. Astronomy is at the forefront of science and technology and has the potential to answer fundamental questions on the origins of the universe and mankind's place in it;
2. It transcends boundaries that divide people and speak to all of society;
3. It is a key driver of innovation and acts as important catalyst for scientific and technological development; and
4. It empowers human capacity through the discovery of new frontiers of knowledge

that will contribute to mankind’s future development.

The need to explore collaboration within the framework of BRICS in the following priority areas is emphasised:

- Policy landscape, national strategies, national plans;
- Key telescope infrastructure, key astronomical institutions;
- Key scientific areas of expertise in Astronomy as well as in enabling technologies for Astronomy including big data; and
- Education and science engagement programmes.

In this regard, high premium is placed on the mobility of researchers and students, access to research infrastructures, and human capacity development (i.e. the involvement of young scientists). Activities within this framework (such as joint workshops, conferences, scientific meetings, exchange short/long term visits, sabbatical leave, and joint supervision of Masters and Doctoral degrees, including joint degrees) should aim at promoting excellence in science and human capacity development. The BRICS astronomy cooperation should also strive to foster public outreach programmes with a view to enhancing public understanding of the social benefits of astronomy both in terms of industrial impact and technological spin-offs. Under the pilot call for proposals on BRICS astronomy cooperation, the following areas are proposed for consideration:

- Promoting astronomy for development in BRICS;
- Developing and leveraging enabling technologies for astronomy, including big data in BRICS;
- *Cooperation in very-long-baseline interferometry* (VLBI) in BRICS;
- Astronomy and public understanding in BRICS.

(f) Biotechnology and biomedicine including human health and neuroscience

One of the hallmarks of XXI century consists in using biotechnology to develop new materials for medicine, novel therapeutics for personalized medicine, long acting drugs, alternative methods to animal testing for non-clinical trials, and in the development of new standards including telemedicine, healthcare of disable and aging persons. The biotechnological revolution applied to molecular biology, immunology and neuroscience allows to discover new cancer antigens, genetic predictors of the development of disease based on genetic and epigenetic aspects, new antibody based therapies and vaccines for cancer and infection diseases, and new drugs to combat autoimmune neurodegeneration and aging. The following areas can be highlighted for this BRICS coordinated call:

1. Personalized medicine based on genetic and epigenetics to treat cancer and autoimmune diseases, including autoimmune neurodegeneration. Deep sequencing of T and B cell repertoires.

2. Development of new drugs:

- Development of new drugs using combinatorial chemistry and biology design of new antibody- based drugs for cancer and autoimmune diseases. Biotechnology aspects of therapeutic antibody expression and purification. Development of novel genetically engineered antibodies towards different pathological targets.
- Development of new long-acting drugs based on engineered recombinant proteins. Design of long leaving insulins, cytokines, and hormones.
- Development of new drugs for neurodegeneration and aging. Telomerase targeted drugs, small molecules and antibodies to treat Alzheimer disease, Huntington disease, Multiple sclerosis.
- Development of new drugs and vaccines to cure and prevent infectious diseases including AIDS, Hepatitis, Tuberculosis and neglected diaseases.
- Antimicrobial resistance. Investigations of new aspects of drug resistance including antibiotics and anti-viral drugs. Computational drug design.
- Development of new drugs to combat neuro- and cognitive dysfunction. Design of new approaches for optogenetics, bioimaging.

3. Design of genetically engineered protein constructs for targeted delivery of anticancer drugs. Drug delivery and radiotherapy.

4. New materials for regeneration medicine. Tissue engineering and 3D bioprinting. Development of new principles of material design including computer simulations, polymer material design.

5. Alternative methods to animal testing for non-clinical trials for non-clinical trials using “lab-on-chip” principles. Development of new platforms for drug testing on human cell lines. Validation of experiments using proteomic, transcriptomic and metabolomics approaches.

6. Telemedicine for healthcare. Development of new devices for telemetric investigations of different aspects of human life. Construction of special highly mobile medical vehicles for on-site medical help and development of new approaches and standards in the field of telemedicine.

(g) Information technologies and high performance computing

Within all the BRICS member countries the utility of high performance computing (HPC) systems form an integral part of national development strategies and the deployment of HPC infrastructures occupy a central place. Presently China is the global leader in the HPC industry, with the Tianhe-2 supercomputer, having maintained its leadership of the Top 500 for the past three years. Similarly, Russia has invested significantly in building its own HPC industry with the renowned HPC developer T-Platforms, having deployed its systems not only in Russia itself but also in other developed economies in Europe such as Germany. Recently through the National Scientific Computing Laboratory (*LNCC*) in partnership with Ministry of Science, Technology and Innovation (MCTI) Brazil acquired its first petascale HPC infrastructure, the biggest supercomputer in Latin America, for open use by the academic community. The supercomputer, named *Santos Dumont* places Brazil among the world’s leading group of nations that have HPC capacities. Today, India has 11 supercomputers in the Top 500 and a combined supercomputing power of the nation at 5.25 petaflops. The prevailing view of the Indian government on HPC is that supercomputing must serve not only to improve India’s large expanding corporate industrial base, but the country’s small and medium business sectors as well. In South Africa the national government has identified HPC as a critical resource to achieve its objectives of building advanced skills required for the knowledge-based economy and promoting competitive and innovative industries. Through the national Centre for High Performance Computing the country has positioned itself as the leader in HPC on the African continent.

It is clear that within the framework of BRICS there are important opportunities for collaboration in HPC that can be aligned to accelerate the national priorities and goals of BRICS member countries to accelerate scientific discovery and engineering design, minimize the time to create and test new commercial products, lower the cost of innovation and develop high-value innovations that would otherwise be impossible. This call for proposal aims at enhancing HPC driving innovation and interdisciplinary collaboration between BRICS' research organizations through joint development of novel algorithms and software scalable up to exascale computer system for solving grand challenge problems in science, engineering and complex system. The priority topics for this first call are:

- Development of novel algorithms and HPC software for processing and analysis of big data;
- Development of novel algorithms and HPC software for solving agent-based model with no less than 100 million agents and detailed hierarchical description down to individual status on the basis of physical geographic information system, to predict emerging phenomena of the socio-economic system in BRICS countries;
- Human Capital Development;
- Building Open Source based architecture and tools to enable deployment of HPC systems;
- Open stack developments in Cloud Computing;
- Digital manufacturing (e.g. 3D printing technology for aircraft, ships, nuclear reactors etc.);
- Energy related technology;
- Astronomy, geosciences and environmental engineering; and
- Smart cities.

Under the pilot call for proposals on BRICS HPC cooperation, the following areas are proposed for consideration:

- Human Capital Development for HPC
- Science Data Processing (SDP)
- Development of the HPC industry.

(h) Ocean and polar science and technology

The general objective of the proposed collaborative research lies in developing novel approaches to monitoring and forecast of marine environment, especially in regions strongly exposed to climate change impacts and anthropogenic pressures. Such key regions in different BRICS countries exhibit both similarities and differences with respect to their geographic and oceanographic settings and environmental stressors involved. The BRICS countries have a long history of oceanographic research, including that in polar and sub-polar areas critically important for global climate. All

BRICS countries maintain research stations in Antarctica, while China, Russia, and India operate also national stations in the Arctic.
The deliverables to be pursued by this cooperative initiative will consist in new observational techniques allowing for high spatial and temporal resolution, as well as advanced numerical models capable of simulating the state of the oceanic systems under a variety of climatic and anthropogenic forcing conditions. The proposed collaborative activities are intended to create benefits to all counterparts. Firstly, comparative joint studies of the addressed processes in the selected areas will elucidate the role of governing processes and physical mechanisms. Secondly, the measuring and modeling tools used by the partner groups, as well as their expertise, will mutually complement each other.

The following priority research areas are proposed for consideration:

1. Quantifying climate change effects in the ocean and their impacts on marine systems.
The manifestations of climate change in the ocean are manifold, encompassing alterations of thermohaline structure, sea level variability, and oceanic circulation. All BRICS countries have actively participated in the international oceanographic research of these effects by means of monitoring cruises, deploying buoys or moored observational systems. Brazil and South Africa, for example, have been strongly involved in monitoring the meridional overturning circulation in the South Atlantic ocean (SAMOC programme), Russia have conducted yearly research cruises in the North Atlantic and the Arctic oceans, while China and India have focused on the Pacific and the Indian ocean, respectively. Collaborative projects centered on climate change in the ocean will therefore give a rare opportunity to develop a synergetic approach to this topic.

2. Understanding the role of high-latitude cryosphere in the global hydrological cycle
The ongoing retreat of high-latitude glaciers is a major mediator of global climate change. The changes in cryosphere exercise dramatic impacts on the ocean leading to increase of ocean level and modulating density regime and circulation. The BRICS countries whose areas of potential interest embrace both polar regions of the globe possess necessary infrastructure and human resources to address the physical mechanisms driving the variability of the high-latitude cryosphere and the associated feedbacks in the Earth system.

3. Continent-ocean interaction

Despite the gap on the scientific knowledge of the continent-ocean interrelations, some topics are considered a priority because of the importance of their role in the modulation of these interactions, such as the applicable scales over the continent-ocean interactions; continental contribution and; large scale ocean circulation. In this sense, it is extremely important an exchange of experiences among BRICS countries researchers related to the continent-ocean interaction projects conducted by each country, with special attention to projects containing elements which make connection of the main basin river with the contribution and dispersion of sediment and nutrients by river deltas in the adjacent coastal regions, as well as impacts from water pollution over the biota and the influence resulted from climate change over the hydrological regime of these hydrographic basin. Furthermore, this exchange of experience proposal should also consider the influence of these elements on biodiversity and biogeochemical cycles of the related environments.

4. Oceans observing systems

The impacts of phenomena and actions, including climate change, are caused by integrated processes at local, regional and global scales, thus justifying the monitoring in different scales. The knowledge about the role of the oceans and its components, the atmosphere and their interactions are of great relevance to contribute to the improvement of weather forecasting, climate and extreme natural phenomena. Thus, the development of a joint ocean observing system aims to expand, consolidate and improve the scientific knowledge, provide the collected data and subsidize studies, forecasts and actions, helping to reduce risks and vulnerabilities resulted from extreme events, climate variability and climate change for the BRICS countries. The proposal is the development of a potential interoperability between observation systems maintained by each of the BRICS countries or an efforts union for the maintenance and data feeding from systems already in operation, as well as intends to seek the exchange of data, human resources and data processing protocols of fixed and drifting oceans observing systems. The experiences exchange proposed could integrate the Atlantic observing systems such as the PIRATE, SAMOC, MOVAR and GOOS, with observing systems operated in the Pacific, Indian and Arctic oceans, to enable an understanding about the global oceanic and atmospheric interactions.

5. Research in deep sea

The deep sea is a new frontier, perhaps the last, which still presents a challenge to humanity on our planet. As a consequence, it has remained historically among the least studied areas in the world, especially with regard to ecosystems, biodiversity and the potential use of natural resources. Descriptions of habitats, species and ecosystems associated with these features are poor and concentrated on the continental margins. This fact has motivated internationally a scientific and technological race, especially in areas beyond the jurisdiction of coastal states (the "Area"), in order to ensure future opportunities for conservation and environmentally responsible production of goods, which are seen as essential to future of humanity. Among the expected products from the deep sea research could be highlighted the characterization of areas of scientific and environmental interest in deep areas. In addition, priority should be given for the exchange and sharing of experiences among BRICS countries researchers to provide better training of human resources with expertise in deep sea subject in its various characteristics such as biology, geology, Physics and chemistry. Thus, the provision of access to research infrastructure to enable and facilitate access to deep sea information should be shared for scientific and technological development purposes.

6. Polar research

The strategic importance of studying both poles simultaneously and in an integrated manner, allowing the exchange of experience among researchers and the shared use of existing research stations infrastructure in the BRICS countries should be taken into consideration. Thus, we suggest the creation of a research program in Arctic and Antarctic continents seeking to stimulate the partnership and the exchange of researchers in the research stations of the BRICS countries. In this context, we propose the following lines of research: the role of the cryosphere in the Earth's climate system and its interactions, highlighting the evolution of biogeochemical processes over the past 12,000 years; the effects of climate change over biological complexity of ecosystems; impacts of human activity on the polar environment; physical and biogeochemical processes associated with climate change in Arctic and Antarctic oceans circulation and its exchanges with sea ice; environmental consequences of the tectonic, paleogeographic and climate changes occurred over geologic time and; chemical dynamics of the upper atmosphere at the poles and the impacts of stratospheric ozone loss in local climate, considering the interaction effects between the Sun and Earth.

(i) Material science including nanotechnology

The rapid development of five priority directions of science, technology and innovations chosen by the BRICS countries and included in the Moscow Declaration and BRICS science, technology and innovation Work Plan 2015-2018 is impossible without development of such fundamental scientific areas as material science. Creation and research of new perspective materials determines the development of the existing branches of economy and sometimes even the creation of new industries.

Materials for Power engineering: functional materials for more efficient accumulation and storage of electric energy; functional materials for alternative (hydrogen and solar) power and catalysts; functional materials for thermal, hydraulic and nuclear energy; new composition materials for power industry; materials for improving the reliability and effectiveness of power supply networks and systems.

Nanostructured materials: nanodevices and nano sensors; nanomedicine; synthesis of nano-biomaterials and their characterisation; nanomaterials in batteries, fuel cells, super capacitor and hydrogen generation; nano sensors and their fabrication and incorporation in diagnostic kits; nano catalysis; nano and advanced coatings; nanocomposites; advanced nano bulk materials with outstanding properties; functional materials with nanoscale dispersion; advanced nanostructured ferroelectric and related materials, ionic and mixed conductors and biomaterials; new nanostructured materials for sensors and transducers based on multicomponent inorganic crystalline, composite and glassy materials; thin films and phase-change materials for data recording and storage; strongly-correlated and low-dimensional systems.

Magnetic materials: nanostructured magnetically-ordered thin-films and bulk materials with new functional characteristics; new functional materials: multiferroics, helimagnets, magnetic fluids and gels, biocompatible magnetic materials; high-efficiency magnetosensitive medium for physical sensing applications; soft magnetic, hard magnetic, and magnetocaloric materials with complex magnetic structure; new effects in the dynamics of magnetic domain structure; composite magnetic materials with polymer matrix.

(j) Photonics

Light and light-based technologies form the foundation of life itself and enable the existence of human society on our planet. Over several decades photonics gradually intertwined into the fabric of our daily lives, revolutionising the global information infrastructure, medical, financial and economic systems, light-based technology is rapidly changing industrial, cultural, economic, and political aspects of global society. Recognizing the importance of the science of light and its applications the United Nations proclaimed 2015 as the year of light and light-based technologies. A number of leading countries declared photonics programme development as their national priority.

Six major thematic fields in this area can be outlined: Data transmission and processing; Bio-photonics and medicine; Energy; Lasers; Sensors; Computer simulation in photonics:

Data transmission and processing: high speed and secure optical fiber communications; optoelectronic components of information networks; optoelectronic devices; photonics materials; high performance optical data storage and processing; space communication.

Bio-photonics and medicine: body parameters monitoring; biosensors; photonics tools and methods for bio systems study; photonics for diagnosis and treatment; photonics for drug delivery.

Energy: photovoltaics: materials, devices, methods; wireless energy transfer.

Lasers: material processing; navigation; metrology and measurement; remote atmosphere monitoring.

Sensors: detectors for extremely low level of contamination values; optical sensors for monitoring parameters of complex systems and structures.

Computer simulation in photonics: computer algorithms for evaluation of optical properties of high contrast composite materials; time efficient algorithms for simulation and optimization of optical properties for periodic/quasi-periodic 3D structured materials; computer simulation of complex photonics devices; computer simulation of high performance information systems.

Please note that the thematic areas and type of supported research vary depending on particular participating funding organization. More details can be found in respecting National Annex document (available on http://brics.rfb.ru/) or from national contact points. However, the general information on thematic areas supported by each of the participating funding organization is presented below:

		Brazil	Russia			India	China		South Africa
	Thematic areas	**CNPq**	**FASIE**	**MON**	**RFBR**	**DST**	**MOST**	**NSFC**	**NRF**
a	**Prevention and monitoring of natural disasters**	V	V	V	V	V	V		V
b	**Water resources and pollution treatment**	V	V	V	V	V		V	V
c	**Geospatial technology and its applications**	V	V	V	V	V	V		V
d	**New and renewable energy, and energy efficiency**	V	V	V	V	V	V		V
e	**Astronomy**		V	V	V	V		V	V
f	**Biotechnology and biomedicine including human health and neuroscience**	V	V	V	V	V		V	V
g	**Information technologies and high performance computing**	V	V	V	V	V	V		V
h	**Ocean and polar science and technology**	V	V	V	V	V		V	V
i	**Material science including nanotechnology**		V	V	V	V		V	V
j	**Photonics**		V	V	V	V	V		V

I-3. Invitation of Proposals and Prospective Applicants

The participating funding organizations shall invite researchers from their countries to identify potential partners in at least two other BRICS countries and to jointly prepare proposals for cooperative research projects in the 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-4. Financial Support

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

The duration of a cooperative research project will be up to three years with start of projects in January 2017.

II. Application

A joint project will comprise of at least one PI from each of the participating countries, and a project coordinator or the leading PI acting as the project coordinator. Project consortia should consist of partners from at least three of the BRICS countries participating in a specific thematic area of the call.

A **Joint Application Form (JAF)** (link for download: http://brics.rffi.ru/rffi/download/Joint_Application_Form%2C_JAF.docx?objectId=1954724) shall first be submitted by the project coordinator to the Call Secretariat through the online submission form at http://brics.rffi.ru/rffi/eng/brics_form. JAF shall be written in English. In addition to the JAF, each national team of a project **shall submit an additional national component** (i.e. proposal) to the relevant national participating funding organization following all required procedures of each particular organization.

The Joint Application Form includes information on:

1) Thematic area;
2) Title and acronym of cooperative research project;
3) Abstract;
4) Proposed period of cooperative research project;
5) Research team;
6) Budget requested.

The national component to be submitted shall vary 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.rfbr.ru/) and on the websites of participating funding organizations.

The project which does not submit in due date a fully completed Joint Application Form to the Call Secretariat or a national components to all

respecting national funding organizations will automatically be considered as non-eligible.

II-2. Preparation of Application Forms

Applicants should agree on aims, strategy of research and management, and the title of the project, and agree on the project coordinator. Based on those agreements the applicants should complete the Joint Application Form (JAF) and national component.

II-3. Submission of Application Forms by Applicants

Applicants should submit the Joint Application Form (JAF) to the Call Secretariat through the online application submission form until **17:00 (Moscow Time, UTC+3) on 25th August 2016**.

To submit an application an online-submission form should be completed at the following webpage: http://brics.rffi.ru/rffi/eng/brics_form. The online submission form fields are identical to the information provided in JAF, however the completed JAF as attachment to the online form must be provided (should be uploaded in a certain field of online submission form).

Applications submitted to the Call Secretariat by any method other than through online submission form at http://brics.rffi.ru/rffi/eng/brics_form, such as post, fax or telex will be rejected.

An additional national component should be submitted to the respective national funding organization according to its own rules and procedures.

II-4. Receipt of Application Forms by Call Secretariat

Following the online submission of an application, the respecting confirmation message with proposal registration number will be shown on confirmation web-page. An additional confirmation message will be also automatically sent to project coordinator (to the e-mail address stated in online-submission form). In case an applicant does not see the confirmation message and does not receive an electronic confirmation e-mail, a Call Secretariat should be contacted in order to make sure the online-submission process was completed and proposal is registered.

III. Evaluation of Project Proposals

III-1. Evaluation Procedure

Each participating funding organization evaluates all proposals where researchers from its own country request funding from their respective funding organization. Based on the results of the evaluation, a joint decision by the participating funding organizations will be made regarding the selected proposals to be co-funded.

III-2. Evaluation Criteria

The following general evaluation criteria will be considered:

- 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 by December 2016 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 will observe the following when carrying out the cooperative research and utilising funding:

IV-1. Progress Report

IV-1.1 Progress Report to the BRICS STI Funding Working Group

Halfway through the research period (i.e. after one and a half years), the leading PI shall promptly develop and submit an integrated progress report to the Call Secretariat on the status of the joint research. The report will be reviewed by the BRICS STI Funding Working Group.

IV-1.2 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 Funding Working Group

After completion of the period of joint research, the project coordinator shall develop and submit within one month an integrated final report to the Call 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 - Pilot call 2016 Secretariat

http://brics.rfbr.ru

Contact person:
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Russian Foundation for Basic Research
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V. Contact information

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

Brazil:

National Council for Scientific and Technological Development (CNPq)

CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico

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National Research Foundation (NRF)

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