

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Mechanisms for Supporting Scientific and Technological Cooperation between the BRICS States: Multilateral Calls and Networking Platform for Knowledge and Technology Transfer.

Balashova M. V.*, Bukhaeva E. E., Kuklina E. R., Luksha O. P., and Yanovsky A. E.

MNiOP Analytical Centre, Russian Federation; Russian Network for Technology Transfer, Russian Federation.

ABSTRACT

The paper covers the work carried out within the framework of the Year of Russia's BRICS presidency (2015-2016) aimed at the development of scientific, technological and innovative cooperation within the BRICS. The work is supported by the Ministry of Education and Science of the Russian Federation. Special consideration is given to the process of creating the means for multilateral R&D cooperation including preparation of the launch of the first BRICS projects call and a pilot version of the networking platform for knowledge and technology transfer between the BRICS countries. A set of recommendations on further development of support measures for multilateral scientific and technical cooperation is provided.

Keywords: international cooperation, scientific and technological development, innovations, BRICS, coordinated calls, networking platform, knowledge and technology transfer, UNIDO.

**Corresponding author*



INTRODUCTION

The development of scientific, technological and innovative cooperation (STI cooperation) of the BRICS countries should be enhanced by creation of effective and flexible mechanisms and means of support for multilateral R&D. Over the last years members of the BRICS international group have instituted long-term large-scale initiatives to strengthen economic, scientific and technological cooperation within the group designed to solve problems of technological modernization and innovative development of the BRICS.

At this stage mechanisms for supporting STI cooperation between the BRICS have been developed: procedures for coordinated calls of joint STI projects, development and launch of a networking platform for knowledge and technology transfer.

The implementation of particular actions at the international level was defined as one of the major task for Russia during its presidency in the BRICS [1]. It includes actions on key issues of science and technology for creating conditions to transform the BRICS into a full featured mechanism of strategic cooperation (in accordance with the Durban Declaration of the BRICS member states.

According to the Concept of participation of the Russian Federation in the BRICS, institutional, financial and human support of scientific, technological and innovative cooperation is one of the basic purposes of Russia's interaction with BRICS member states in the area of science, technology and innovations. It involves identification of hi-tech areas (science parks) and incubators, development of common technological platforms, promotion co-investment in hi-tech, research facilities and technology hubs development, such as Skolkovo in Russia and similar centers in other BRICS states, as well as increasing collaboration in the field of education, scientific staff training, and implementation of joint research programmes [2].

The Russian Federation has bilateral agreements on STI cooperation with all BRICS states: meetings of bilateral committees for scientific and technological cooperation are regularly held, implementation of agreements is being monitored. The Memorandum of Understanding on Cooperation in Science, Technology and Innovation (hereinafter - MoU) and the Brasilia Declaration of the Ministers for Science, Technology and Innovation of the BRICS member states, March 18, 2015 have been the main legal documents of multilateral cooperation within the framework of the BRICS international association until recently. In October 2015 these documents were followed by the Moscow Declaration of the Ministers for Science, Technology and Innovation of the BRICS member states and the BRICS Science, Technology and Innovation Work Plan 2015-2018, signed at the III BRICS Science, Technology and Innovation Ministerial Meeting in Moscow.

The MoU defines key formats of multilateral cooperation, in particular, the need for strategic cooperation on the selected priority areas is emphasized [3]. Moreover, the Brasilia Declaration provides the need of the development of the Working Plan to ensure systematic and structured work: establishing executive and working bodies and mechanisms for their interaction at different levels, developing mechanisms for call project support, creating common information space, establishing centers of common use to provide BRICS scientists with equal access to research infrastructure, providing network interaction between scientific, educational and commercial sectors of research and development [4]. Russia during its BRICS presidency in 2015 took the leading and coordinating role in the development of the Working Plan, which was eventually signed at the meeting of the ministers for science, technology and innovation.

The Working Plan was developed taking into account the analysis of previous legal documents. The Working Plan provides the implementation of the BRICS Research and Innovation Initiative (hereinafter – BRICS R&I Initiative), which involves a number of institutional, financial and human resources actions for cooperation in the priority areas. BRICS R&I Initiative has several strategic mainstreams: BRICS Framework Programmeme for funding joint projects for research, technology commercialization and innovation; BRICS Research and Innovation Networking Platform (BRICS TTN platform); GRAIN (Global Research and Infrastructure Network). The implementation of the suggested mechanisms has been initiated in accordance with the BRICS Action Plan 2015-2016 developed within the Working plan. Moreover, these aspects of cooperation are in line with the main provisions of the Ufa Declaration adopted at the Seventh BRICS Summit of the leaders of the BRICS countries on July 9, 2015 and the Strategy for BRICS Economic Partnership for the

period until 2020. According to the Strategy, the use of joint R&D and innovations results for solving common social and economic problems is a fundamental issue of STI cooperation within the BRICS [6].

MATERIALS AND METHODS

The Ministry of Education and Science of the Russian Federation approved establishing the Council for Scientific, Technological and Innovative Cooperation (BRICS STI Council) at the national level for the purpose of coordinating the actions of various departments and organizations, which develop and implement the state policy in the area of international scientific and technological cooperation within the BRICS to ensure efficient implementation of the BRICS R&I Initiative. The five expert working groups (EWG) were formed within the Council in the following areas to provide the operational work and to address the full range of the set tasks with regard to the key components of cooperation determined in line with Article 8 of the Brasilia Declaration:

- setting up priorities within STI BRICS cooperation;
- research infrastructure network;
- implementation of the BRICS multilateral research initiative and coordination of joint call;
- innovative cooperation;
- work within the framework of a common research and innovation platform network.

EWG members are representatives of key relevant ministries, departments and expert organizations. Working groups provide the Council activity with expert support including estimation of the current state of cooperation lines, formulation of proposals on cooperation development, recommendations on implementation of programmes and events.

The format of EWGs' activity and its work coordinated by the Council proved to be efficient, EWG representatives took an active part in the development of the Working plan and the Moscow Declaration, provided the Ministry of Education and Science of the Russian Federation with expert and organizational support while preparing and holding events within the frame of the Year of Russia's Presidency in the BRICS. At the last senior officials of science, technology and innovation meeting the Russian side demonstrated the results of the Council cooperation and taking into account the positive experience of using the five-sided format of interaction at the national level suggested to consider the possibility of its internationalization. Following the discussion of the experts the Working plan provided creation of two Working groups: the Working group on the BRICS research infrastructures and the BRICS Funding Working Group.

The first meeting of the Working group on the BRICS research infrastructures is planned to be held in 2016. The opportunities of collaboration of the BRICS countries in the area of major research infrastructures including mega science projects were discussed at the "Research Infrastructure of the BRICS Member States" round table within the framework of the meeting of ministers for science, technology and science on October 28, 2015 in Moscow. The discussion participants were unanimous on the need for consolidation of efforts and coordination of the BRICS countries' actions in this area. Coordinated actions of the BRICS countries in the area of cooperation prioritization will facilitate the implementation of the coordinated call of the BRICS STI Framework Programme in an efficient manner.

A meeting of the BRICS Funding Working Group, that included the representatives of BRICS funding organizations, was held in January, 2016 in Beijing. Representatives of the BRICS member states discussed the launch of a multilateral research projects pilot call. Projects in the area of technology commercialization and innovation, agreed upon draft documents in framework of the call and a provisional schedule of call procedure.

It's possible to get the general idea of scientific competences of the BRICS countries by research trends based on the statistical data on publications in Web of Science in 2011 represented below (Table 1).

- Confirming the priority areas of cooperation according to Art.3 of Memorandum of Understanding on Cooperation, the Brasilia Declaration assigned the following thematic priorities to the BRICS countries:
- Prevention and mitigation of natural disasters (Brazil);
- Water resources and pollution control (Russia);

- Geospatial technology and its applications for the purpose of development (India);
- New and renewable power generation, energy efficiency (China);
- Astronomy (South Africa).

Table 1. The statistical data on publications in Web of Science in 2011

2011	All areas	Physics	Chemistry	Biology	Computer science	Earth sciences	Astronomy	Agriculture
World	827 705	108 551	115 188	161 652	9 266	46 218	10 561	19 127
BRICS	142 799 (17.3%)	28 401 (26.2%)	34 727 (30.1%)	22 380 (13.8%)	1 775 (19.2%)	7 339 (15.9%)	1 407 (13.3%)	3 141 (16.4%)
China	89 894	17 474	22 343	13 330	1 492	4 298	570	1 879
India	22 481	4 014	6 178	3 814	165	1 052	298	523
Russia	14 151	5 220	4 228	935	21	943	367	19
Brazil	13 148	1 461	1 623	3 471	84	758	125	608
South Africa	3 125	232	355	830	13	288	47	112

During the meeting of the BRICS ministers for science, technology and innovation in Moscow 6 new lines of cooperation were approved including researches in the area of material sciences, nanotechnology, processing technology and high-performance computing, ocean and the Arctic Region, photonics, and biomedicine. The established thematic priorities of cross-disciplinary nature are focused on solving global challenges of the modern world. In fact the countries' opportunities in the full-scale solution of the entire range of the tasks in the selected priority areas remain questionable. They are apparently limited by infrastructure and scientific possibilities of each of the countries individually.

Representatives of the relevant Russian EWG made a proposal to carry out common technological and educational foresight of the BRICS countries to solve the tasks in hand associated with specification of the BRICS cooperation priorities. An algorithm for holding working panels/meetings, a short-term training programme and sharing of experience in the sphere of scientific, technological and innovative policy is being elaborated.

The BRICS TTN platform should become the main mechanism for coordinating the BRICS actions in the context of BRICS R&I Initiative implementation according to the provisions of the Working plan and the Moscow Declaration. Representatives of the expert working group on common research and innovative networking platform within the BRICS STI Council analyzed the current state and opportunities of the network cooperation of the BRICS countries. Following the analysis results a project of information and communication system for the BRICS TTN was developed and proposed for pilot field-testing (<http://brics-ttn.org/>). Advantages of the BRICS TTN platform could be used already this year for the purpose of forming multilateral research consortiums developing the BRICS pilot multilateral call.

EXPERIMENTAL

Key STI cooperation formats

Despite the solidarity in BRICS countries' scientific interests, there's a little experience of supporting multilateral joint research projects within five countries. In 2015 the Ministry of Education and Science of the Russian Federation held an initiative call of joint research projects with BRICS countries within the framework of the Federal Target Programme "Research and Development in the Priority Areas of Development of the Russian Scientific and Technological Complex for 2014-2020" (the FTP R&D for 2014-2020). Based on the call results 22 projects totaling over 330 million roubles of allocated financing were supported [7]. The analysis of foreign partners in the requests approved for call selection demonstrates the high interest of Russian researchers and research groups in the participation in common projects with the BRICS countries (Figure 1).

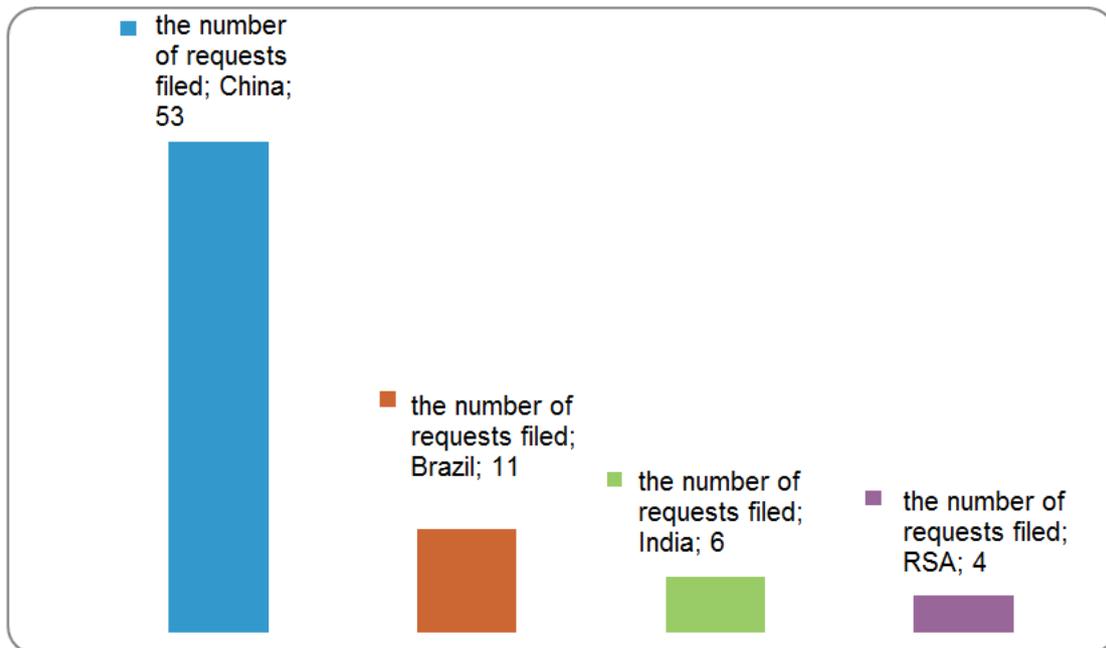


Figure 1. Joint research projects with BRICS countries

Note:

There were 87 requests filed in total, 73 of them were approved for competitive selection: 3 requests for execution of projects jointly with research organizations from RSA, 6 requests for execution of projects with Indian research organizations, 52 requests for execution of projects with research organizations from China, 10 requests – with organizations from Brazil, 2 requests for execution of a multilateral project.

The cooperation between Russia and China develops most intensively, this fact is proved with the high number of call proposals. There is a resurged interest in the cooperation with Brazilian organizations. Russia and India are considered strategic partners in the field of science and technology; Russian researchers traditionally take part in joint projects with Indian organization in line with the FTP R&D for 2014-2020. The cooperation between Russia and South Africa in the area of science and technology is effected only in a few areas (South Africa is an associate member of the Joint Institute for Nuclear Research, cooperates with Kurchatovsky Institute research center, Roscosmos federal space agency, but their collaboration in the framework of the FTP R&D for 2014-2020 is less developed.

The BRICS Framework Programmeme for funding joint projects for research, technology commercialization and innovation is proposed as the main mechanism for supporting joint researches within the BRICS club. This BRICS Framework Programmeme is designed to unite the concerned national funding parties of the BRICS states.

The first pilot coordinated call of multilateral research and development projects will be launched in 2016 in line with the provisions of the Working plan. Joint projects should be carried out in consortiums consisting of partners from at least three BRICS member states by the selected thematic areas defined in the Brasilia Declaration as well as in the Working plan.

The ERA-NET¹ mechanism developed by the European Union is taken as a basis of the coordinated call as most flexible and understandable to all the parties involved. The budget of joint projects in the calls

¹ ERA-NET mechanisms are designed to strengthen the coordination of participating countries' research activity in order to avoid research space fragmentation. Representatives of national ministries and funding parties are project participants. The ERA-NET mechanism offers various measures for international coordination of financing of existing and new research and development programs. The purpose is to unite the resources of individual countries to carry out joint calls in separate areas of research and development and, therefore, strengthen them to the maximum.

organized according to this mechanism is made of contributions of participating funding parties. In this case allocated funds do not cross national boundaries – each of participating funding parties finances its researchers in compliance with national rules and regulations. Call management is jointly carried out by participating funding parties at all stages.

Projects are reviewed and selected at the national level with subsequent joint discussion of the results and joint project selection. National Funding Parties assess proposals in accordance with their requirements and procedures. Then the BRICS Funding Working Group discusses proposals with assigned national expert points based on selection criteria and available funding to form a pool of high quality recommended proposals as a result. The BRICS Funding Working Group makes final joint recommendations on project selection and financing; a formal decision on funding is made by the national Funding Parties.

For example, the Ministry of Education and Science of the Russian Federation will support Russian researchers in coordinated projects on a call basis through the section 2.1 of the FTP R&D for 2014-2020. In addition the following organizations take part in the BRICS STI Framework Programmeme: the Russian Foundation for Basic Research (RFBR) and Foundation for Assistance to Small Innovative Enterprises (FASIE) (Russia); the State Council for Scientific and Technological Development (Brazil); the Science and Technology Department (India); the Ministry of Science and Technology and the State Foundation of Scientific Researches (China); the State Research Foundation (South Africa).

The opportunity to support research studies covering a wide range of science disciplines, multi-disciplinary projects is an evident advantage of this mechanism. That said, several member countries could gain benefits of projects. This is fully fair in regard to basic research projects and partially in regard to large application projects aimed at life quality improvement, particularly, energy and clean water supply, environmental protection, security assurance, healthcare, etc. Experts state that projects in the area of technology commercialization and innovation projects are more successful in general when they're carried out on a bilateral basis.

Currently a pilot call of the BRICS STI Framework Programmeme is being initiated. The Russian side agrees upon the procedures for the call launch, the scope of financing on the basis of Call Secretariat rights. The Ministry of Education and Science of the Russian Federation provides financing on the Russian part within the framework of the FTP R&D for 2014-2020 and RFBR.

RESULTS AND DISCUSSION

Based on the analysis of experience of implementing international initiatives on the support of multilateral scientific and technological cooperation (primarily on the ERA-NET European model) [8,9], it's possible to distinguish a number of factors, which exercise a significant influence on the performance of projects and formation of consortiums for their implementation, particularly, for STI cooperation of the BRICS countries:

- consistency (harmonization) of detail scientific technological priorities of cooperation;
- cooperation potential members' awareness of opportunities, competences, "rules of the game";
- developed partner search services for joint project organization (the most popular service for scientific organizations and SME);
- companies researchers' and employees' possession of skills and competences of network interaction and project management [10];
- consideration of cultural differences, including the level of readiness to international cooperation.

It should be noted, however, that problems associated with partner search are the major (following financial resources availability) barrier from the perspective of potential members of international cooperative projects. This explains the fact that a special emphasis was put on the goal-oriented work on the development of relations between potential partners, raising awareness of their competences and needs, organization of special events and meetings to discuss project proposals implementing European programmemes (FP6, FP7,

Horizon 2020), as well as ERA-NET multilateral initiatives. This work, as a rule, is performed in the format of so-called support actions.

In this respect networking platform projects have become widespread. Networking platforms are communication platforms, which unite organizations and professionals interested in the international cooperation within a specific thematic area using various instruments. Such instruments include special-purpose information and communication systems, broker events, workshops, conferences, etc.

Creating a networking platform supporting scientific and technological cooperation between the BRICS countries is a relevant objective. Despite current bilateral scientific and technological projects, the development of multilateral cooperation is a new format and requires special supporting instruments.

A special working group within the BRICS STI Council under the Ministry of Education and Science of the Russian Federation was formed to develop the concept of this networking platform. The expert group suggested conducting field-testing of an information and communication system for technology and knowledge transfer network, which was developed under the auspices of UN Industrial Development Organisation (UNIDO) for the BRICS countries – the BRICS Technology Transfer Network – BRICS TTN (<http://brics-ttn.org/>) as the first practical step for creating the platform.

The BRICS TTN sets the following major tasks:

- promoting the international technology and knowledge transfer between the BRICS countries, regardless of their origin, in line with network local members' needs (companies, research organizations and centers, universities, etc.);
- promoting the cross-country spread and use of scientific findings and innovative developments obtained at the national level in the BRICS, particularly, while implementing national or international programmes supporting STI cooperation;
- development of a range of key services, which contribute to the international technology and knowledge transfer;
- promoting synergy between the BRICS TTN platform and innovative networks in the BRICS countries and other countries.

The following roles of network participants/members are distinguished in the BRICS TTN organizational framework:

- Organization – a research and development center or an university, innovative company, center of competence, etc. - operates within the network in its own name, representing its own scientific and technological proposals and requests;
- scientific and technologic broker – an intermediary organization (a technology center or technology hub, center of competence, etc.) - operates on behalf of its client organizations in a particular region (geographical segmentation) or a particular sector (thematic segmentation), representing their scientific and technological proposals and requests;
- coordinating organization / team - manages and coordinate the network members' work at the national level (BRICS national coordinator) or at the network-wide level (network coordinator).

The BRICS TTN business process is generally divided into 6 stages as follows (Figure 2):

- Marketing activity;
- Organizations'/clients' need identification;
- Making a scientific and technical request or offer profile for establishing partnership;
- Profile promotion and following;
- Express of interest;
- Negotiating and making decision on cooperation.

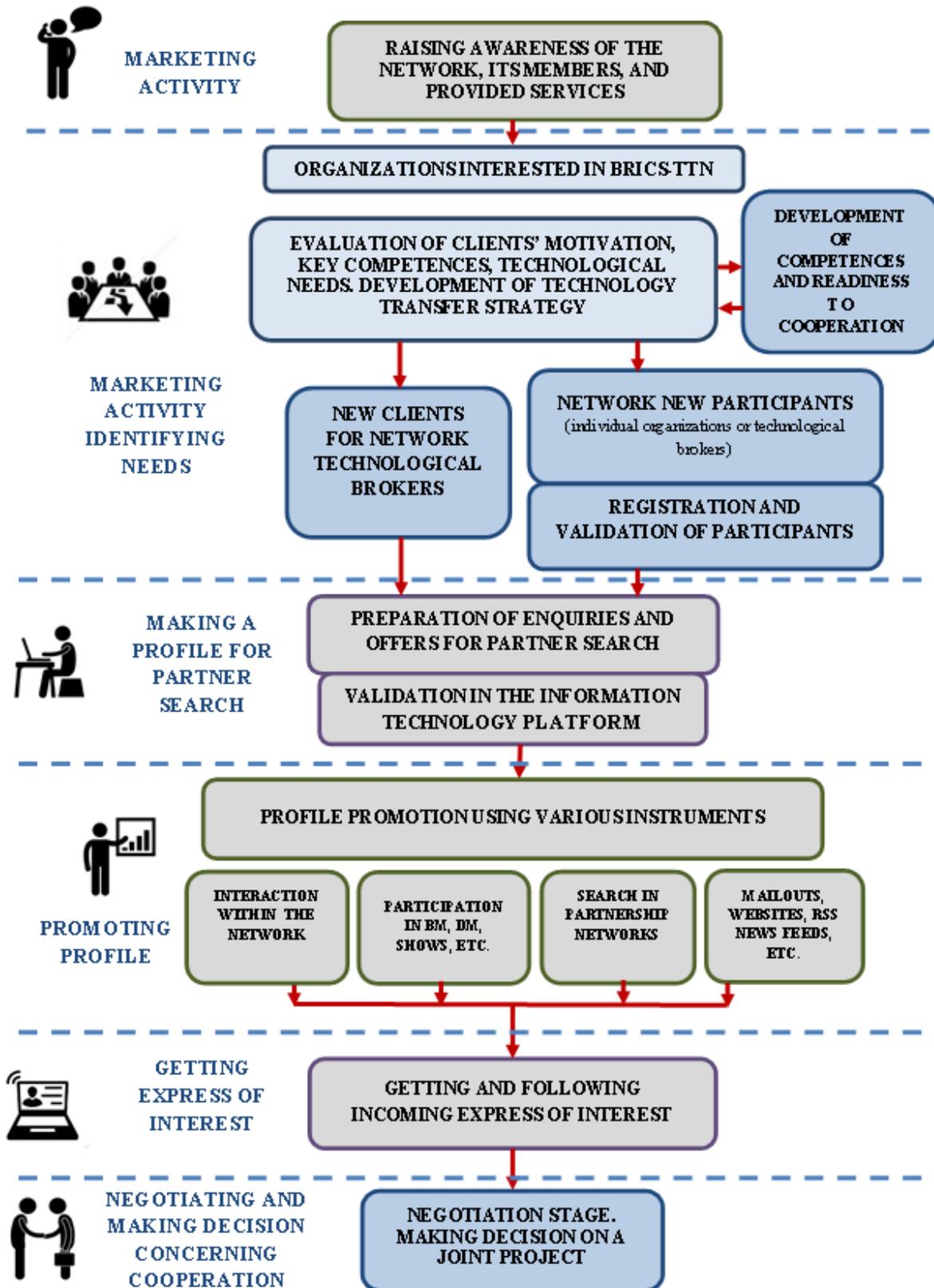


Figure 2. The 6 stages of the BRICS TTN business process

A special information communication system (ICS) was developed to ensure communication between BRICS TTN members. The ICS for BRICS TTN members is an instrument for automation the business process of knowledge and technology transfer between its members, as well as coordination of network members.

The automation and support of the system operation on the ICS part include the following components:

- Network interaction: organization of professional communication between network participants;
- Coordination: assessment and registration of network participants, methodological support, network members' activity monitoring;
- Promotion: provision of information on events, scientific and technical conferences, technological missions, broker meetings, exhibitions, etc.;
- Assessment of organization's readiness to technology and knowledge transfer, assistance in defining international cooperation policy:
 - creating an organization's registration card;
 - inner monitoring of interaction with potential partners, results of broker activity, recording express of interest;
 - preparation to conclusion of agreements and contracts with partners.
- Scientific and technological request and offer profile database management, including requests for joint researches;
- Organization of participation in calls and programmes for supporting research and technological projects:
 - creation and maintenance of international programmes and calls databases;
 - collecting draft project proposals;
 - consultation on request preparation, guidance materials.
- Organization of participation in broker events and business missions (shows, forums, etc.):
 - registration and maintenance of corresponding broker events and missions data bases;
 - event pre-registration;
 - meeting planning.

The BRICS TTN Platform is expected to be used as an instrument for searching for partners of the first BRICS multilateral call, which is planned to be held in 2016. To that end already over 20 Russian organizations interested in joint STI projects prepared and posted corresponding profiles of scientific and technological requests/proposals.

CONCLUSIONS

Following the carried out analysis with due consideration of the expert working groups' work experience and the previous experience of Russian organizations in European multilateral scientific and technological calls, the following recommendations on increasing the efficiency of international STI cooperation support within the BRICS group are proposed. They can be used and adopted at the interdepartmental and interstate level:

- The model of expert working groups by the priority areas of STI cooperation coordination within the BRICS proved its efficiency at the national level (in the Russian Federation). Nonetheless, increasing their activity efficiency and delivery requires internationalization of these groups covering all the BRICS countries. The working practice of such working groups in the Russian-European cooperation proved that so called support actions are an efficient form of addition to and improvement of their performance. These international projects developed detail analytic materials, priority analysis proposals, draft agreements, etc. for their further review by working groups. This practice should be introduced while organizing the cooperation within the BRICS.
- Taking into account new geographic focus on the BRICS countries, it appears necessary to enlarge and extend the functions of "national focal points" (NFP) for supporting the international STI cooperation with the EU countries. To that end it's recommended to review the contract system for NFP base organizations, selection procedure, monitoring and accounting standards, as well as to make provisions for practical mechanisms for organizing the network cooperation of these organizations and their integration in international innovative networks, particularly, on the BRICS TTN platform.

- It's necessary to define target groups of Russian associations and organizations with maximum potential for successful participation in the multilateral cooperation with the BRICS countries and concentrate efforts on the work with these groups.
- The development of a single ICT (networking platform), which would be connected with national Internet-resources of BRICS countries and include special purpose services for partner search, is an important mechanism for supporting infrastructure integration. It's recommended to use the BRICS TTN platform as a basis for ICT development.

ACKNOWLEDGEMENTS

The paper is prepared under the grant provision agreement with the Ministry of Education and Science of the Russian Federation as of October 19, 2015 No. 14.603.21.0015 ID RFMEFI60315X0015.

REFERENCES

- [1] Durban Declaration of the heads of BRICS member states, March 27, 2013.
- [2] Concept of participation of the Russian Federation in the BRICS.
- [3] Memorandum of Understanding on Cooperation in Science, Technology and Innovation between the Governments of the Federative Republic of Brazil, the Russian Federation, the Republic of India, the People's Republic of China and the Republic of South Africa, adopted as a result of the meeting of representatives of the BRICS Ministers for Science, Technology and Innovation.
- [4] Brasilia Declaration of the BRICS Ministers for Science, Technology and Innovation (March 18, 2015, Brasilia, Brazil).
- [5] Ufa Declaration of the BRICS Ministers for Science, Technology and Innovation (July 9, 2015, Ufa, Russia).
- [6] The Strategy for BRICS Economic Partnership for the period until 2020.
- [7] Evaluation protocol and comparison of requests for participation in the competitive selection for provision of grants from the federal budget as of October 2, 2015. Research and Development in the Priority Areas of Development of the Russian Scientific and Technological Complex for 2014-2020 Federal Target Program official website: http://www.fcpir.ru/participation_in_program/contests/list_of_contests/6_competitionfinished/2015-14-585-0002/.
- [8] Luksha O., Pilnov G., Yanovsky A. Infrastructure of Support for the Projects of International Scientific And Technological Cooperation of Russia and the UN: Current State and Prospects, Innovations 2013; 4: 22-25.
- [9] Vinova. Good Practice Guide "Increasing the Impact of National Research Programs through Transnational Cooperation and Opening", Expo, 2005, pp. 16-48.
- [10] Luksha O., Vindishbaur B., Jacobs-Bokhak S., Mazurina O. How to Built Networking/Communication Effectively in International Research and Development Projects (2nd edition), BILAT-RUS-Advanced, 2015, pp. 56-79.