



**BRICS**  
2017 CHINA

# BRICS Innovative Competitiveness Report 2017

China Science and Technology Exchange Center

# ***BRICS Innovative Competitiveness Report 2017***

## **EDITORIAL BOARD**

Director: Huang Wei

Deputy Directors: Ye Dongbai    Chen Jiachang

Members (by alphabet):

Alexander Sokolov	Chen Linhao	Chen Xiong	Gao Changlin
Guo Xiangyu	Huang Maoxing	Huang Wei	Li Minrong
Wang Ling	Wen Jun	Zhang Shirong	Zhao Xijun
Zhao Xinli	Zhen Shimin	Yang Xuemei	

Chief Editors:

Zhao Xinli    Li Minrong    Huang Maoxing

Deputy Chief Editors:

Alexander Sokolov    Zhao Xijun    GuoXiangyu    Zhang Shirong

Executive Editor: Ma Zongwen

Editors (by alphabet):

Anna Grebenyuk	Anna Pikalova	Chen Qiang
Dong Quanchao	Gao Changlin	Gao Mingyuan

GuoXiangyu	Huang Maoxing	Huang Xinhuan
HuoHongwei	Leonid Gokhberg	Li Minrong
Li Wenjing	Liu Xiaoyan	Ma Zongwen
Maxim Kotsemir	Sergey Shashnov	Shao Mengzhu
Shi Tao	Tang Jie	Tatiana Kuznetsova
Wang Dan	Wang Lei	Wang Zhongcheng
Wang Zhongyang	Wei Boyang	Wen Jun
Xiao Yi	Xin Bingqing	Yang Yefeng
Zhang Dong	Zhang Pei	Zhang Shirong
Zhao Xijun	Zhao Xinli	Zhen Shimin

Translators:

Li Zhiqiang	Zheng Wei	Pan Hua
Chen Yuheng	Dai Le	Xia Huanhuan

# CATALOG

Introduction

Preface

## I General Reports

Chapter1 Forecast and Evaluation of Innovation Capabilities & Review of STI Cooperation of  
BRICS..... 13

Chapter 2 S&T Priorities for BRICS Countries: In Search of a Win-win Strategy ..... 16

## II Country Reports

Chapter 3 Brazil Report on Science, Technology and Innovation ..... 20

Chapter 4 Russia Report on Science, Technology and Innovation ..... 22

Chapter 5 Overview of Science, Technology and Innovation Development in Russia..... 24

Chapter 6 India Report on Science, Technology and Innovation ..... 29

Chapter 7 China Report on Science, Technology and Innovation ..... 31

Chapter 8 South Africa Report on Science, Technology and Innovation ..... 33

## III Thematic Reports

Chapter 9 Study on Digital Technology in BRICS ..... 36

Chapter 10 Study on Technologies for Financial Inclusion in BRICS ..... 38

Chapter 11 Study on Energy Technology in BRICS ..... 41

Chapter 12 Study on Agricultural Technology in BRICS..... 43

## Appendix

Appendix 1 Indicators and Evaluation System of Overall Innovation Capabilities of BRICS  
Countries and Their Roles in Evaluation and Forecasting ..... 46

Appendix 2 Fundamental Documents Specifying the Framework of BRICS STI Cooperation49

Postscript ..... 83

# INTRODUCTION

## Strengthen Innovation Cooperation to Shape the Future

Science, technology and innovation are crucial driving forces in the development of a country and a nation and of the entire human society at large. The competition in comprehensive national strength, in essence, is the competition in science, technology and innovation. In the backdrop of globalization, a country which has strong science, technology and innovation capabilities is more advantageously positioned in the division of labor in industries and better able to create new industries and can own more advanced intellectual properties needed to achieve further development. Science, technology and innovation hold the golden key to discovering new fountainheads of growth and unlocking dormant growth potential. Although the global economy remains sluggish overall, a new round of scientific, technological and industrial revolution is creating new historic opportunities as new concepts and new sectors such as “Internet+”, 3D printing and smart manufacturing emerge and new technologies keep coming up, especially in artificial intelligence, information technology, life science and biotechnology, opening up unprecedented opportunities and development impetus, also with a massive potential of transforming traditional industries. In addition, science, technology and innovation play an irreplaceable basic role in the effort to respond to global challenges and can not only effectively promote the addressing of global challenges such as climate change, food shortage, resource depletion and poverty but also accelerate the achievement of the goals set forth in the 2030 Agenda for Sustainable Development for the benefit of the entire humankind.

The formation and development of the BRICS group of countries (Brazil, Russia, India, China and South Africa) have reflected the process from quantitative to qualitative change in the evolving of the international economic and political landscape, adapted to the trends of the times, and advanced the establishment of a fairer and more rational international order.

The BRICS cooperation mechanism has become a role model of cooperation between emerging economies and developing countries and will continue to generate benefits for the peoples of its member countries and make important contributions to the effort of promoting global economic growth, driving science, technology and innovation, and achieving sustainable development. The BRICS countries represent approximately 42% of the world population and occupy 30% of the earth's territory with a combined nominal GDP of approximately 23% of the world GDP and a combined trade volume of approximately 16% of the world trade. Over the past decade, the BRICS countries have contributed over half of the global economic growth. As the leading group of emerging market countries in the G20, the BRICS countries play an irreplaceable role in South-South cooperation in science and technology and South-North dialogue on innovation, serving as a principal group in leading science, technology and innovation in developing countries and an important force in global science, technology and innovation. BRICS countries invest heavily in research and development, with the annual R&D expenditures accounting for approximately 17% of the world's total, high-tech exports reaching nearly USD6 trillion or approximately 28% of the world's total, and publications of science papers totaling 590,000, approximately 27% of the world's total. As their contribution to global science, technology and innovation steadily increases, the international influence of the BRICS countries has been improving as well. The BRICS countries are pacesetters and leaders in their respective regions and lead regional countries in scientific, technological, economic and social development.

The world economy is experiencing a zigzag recovery from a deep decline and going through a crucial period of transition with traditional drivers being replaced by new ones. The new round of scientific and industrial revolution and industrial transformation is gathering momentum as the world enters a period of active and intensive innovation. The BRICS countries have their respective strengths in extensive areas including talent, science and technology, and resources and have a huge potential of achieving interconnected development. The close cooperation of the BRICS countries will increase the say of developing countries on international political, economic and science and technology affairs,

promote timely sharing of their respective experience, accelerate their economic transformation, and provide new drivers to the global economic growth.

The year 2017 has commenced the second decade of the BRICS cooperation and will see the convening of the Fifth BRICS STI Ministerial Meeting in Hangzhou, China, in July, and the Ninth BRICS Summit in Xiamen, China, in September. Developing from “BRIC” to today’s “BRICS”, the BRICS mechanism of science and technology cooperation has become increasingly mature. As the influence of the BRICS continues to increase, the BRICS countries will have even better development prospects. The steadily growing science, technology and innovation force of the BRICS countries will also strengthen the BRICS cooperation mechanism and its influence. Let’s act in unison to respond to the four expectations put forward by Chinese President Xi Jinping of the Ninth BRICS Summit: deepen pragmatic cooperation to achieve mutual benefit; strengthen global governance to address challenges together; carry out people-to-people exchanges to solidify popular support; and promote institutionalization to build partnership in wider areas.

Innovation drives development, and cooperation creates a bright future for all. The BRICS countries, who share the same destiny, are a community of shared interests and benefit from acting in concert. We believe that, through the concerted efforts of the BRICS countries, the BRICS science, technology and innovation cooperation will open up an even better future. The future is for us to create together!

Dr. Huang Wei



Vice Minister

Ministry of Science and Technology

People’s Republic of China

July 2017

# PREFACE

## Remarks at the Opening Ceremony of the 5<sup>th</sup> BRICS Science, Technology and Innovation Ministerial Meeting

WAN Gang

Honorable ministers of BRICS Countries,

Ladies and gentlemen,

Dear friends:

Good morning! It is my great pleasure to gather with you in Hangzhou, one of the most innovative cities in China, for the Fifth BRICS Science, Technology and Innovation Ministerial Meeting by the beautiful West Lake. First of all, I would like to extend, on behalf of the Chinese government, sincere welcome and best wishes to all the ministers, delegates and guests coming from afar.

Last September, leaders of the Group of Twenty (G20), which includes the BRICS countries, gathered in Hangzhou for a summit meeting on the theme of "Towards an innovative, invigorated, interconnected and inclusive world economy" and achieved fruitful results. For the first time, the Summit listed "Innovating upon growth patterns" as a key topic. On November 4, 2016, the G20 Science, Technology and Innovation Ministers Meeting was held in Beijing, and attended by BRICS science, technology and innovation ministers. During the event, we worked together and reached a *Statement of the G20 Science, Technology and Innovation Ministers Meeting*. All these have pointed to a new direction, planned a new path and injected new impetus to the social and economic development of not only G20 countries but also our BRICS countries and even the whole world.



Today, we, the ministers of science and technology of the BRICS countries, gather here to further implement the outcome of the G20 Hangzhou Summit. It is of great significance for putting forward a “BRICS Solution” for and contributing “BRICS wisdom” to innovative growth.

As the first echelon of emerging markets of the G20 countries, the BRICS countries play an irreplaceable role in South-South cooperation in science and technology and in North-South dialogues on innovation. The BRICS countries are the main group that leads science and technology innovation in developing countries, as well as an important force of science and technology innovation in the world. As for science and technology innovation, the BRICS countries make up approximately 17% of the world’s gross annual R&D expenditure, have a hi-tech product export volume of nearly \$6 trillion or approximately 28% of the world’s total, and boast 590,000 published papers in science and technology journals, accounting for approximately 27% of the world’s total. There has been a gradual increase in BRICS’ contribution to science, technology and innovation in the world, and the international influence of the BRICS countries is increasing. The BRICS countries have become a “bellwether” in their respective regions, leading the development of science and technology, economy and society in neighboring countries.

Looking back, the First BRICS Science, Technology and Innovation Ministerial Meeting on the theme of “A Strategic Partnership for Equitable Growth and Sustainable Development” was held in South Africa in February 2014. At the meeting, we signed the *Cape Town Declaration* together, marking the official establishment of the mechanism of cooperation in science, technology and innovation between the BRICS countries.

In March 2015, the Second BRICS Science, Technology and Innovation Ministerial Meeting was held in Brazil. We adopted the *Brasilia Declaration* and signed the *Memorandum of Understanding Between BRICS Countries on Intergovernmental Cooperation in Science, Technology and Innovation*, identifying 19 priority fields of cooperation and specifying new directions for cooperation in science, technology and innovation.

In October 2015, the Third BRICS Science, Technology and Innovation Ministerial Meeting was held in Russia, carrying a theme of “BRICS Partnership – a Powerful Factor of

Global Development”. The meeting issued the *Moscow Declaration* and agreed on BRICS cooperation within large research infrastructures, coordination of the existing large-scale national programs of the BRICS countries, development and implementation of a BRICS Framework Program for funding multilateral joint research projects, technology commercialization and innovation, as well as establishment of BRICS Research and Innovation Networking Platform. The meeting also approved the *2015-2018 BRICS Work Plan for Science, Technology and Innovation*.

In October 2016, the Fourth BRICS Science, Technology and Innovation Ministerial Meeting was held in India. Carrying a theme of “Building Responsive Inclusive and Collective Solutions”, the meeting adopted the *Jaipur Declaration*. The First BRICS Young Scientists Forum was also held in India.

The current BRICS Science, Technology and Innovation Ministerial Meeting has “Leading through innovation & deepening cooperation” as its theme and will focus on exchange of views concerning BRICS STI policies, cooperation in thematic fields, joint sponsorship of multilateral R&D projects, youth innovation and entrepreneurship, science park cooperation and other important topics. Thanks to this meeting, we hope that we can continue to strengthen innovation and entrepreneurship policy and conduct exchanges between BRICS countries, promote S&T innovation and entrepreneurship platform building in the BRICS countries, and deepen technology cooperation among enterprises, technology transfer and commercialization, science park cooperation and youth innovation and entrepreneurship cooperation between the BRICS countries. This meeting intends to issue a *Hangzhou Declaration* and will deliberate on and adopt a *BRICS Innovation Cooperation Action Plan* to contribute STI plans to the outcomes of the BRICS Leaders Meeting in Xiamen in September.

Ladies and gentlemen, friends,

Science and technology is the foundation of national prosperity, and innovation is the soul of national progress. The Chinese government attaches great importance to science, technology and innovation, regards it as a strategic support for raising productivity and improving comprehensive national strength, and places it at the center of overall national development. Currently, China is thoroughly implementing an innovation-driven

development strategy. In recent years, China has made a series of breakthroughs in science, technology and innovation: national technological strengths and innovation abilities have been further improved, and various science, technology and innovation achievements have been made; science, technology and innovation has been integrated into overall economic and social development, speeding up new driving forces for growth and playing a markedly improved role in supporting and leading the supply-side structural reform; mass innovation and entrepreneurship is thriving and the whole society is ever more enthusiastic about supporting and participating in innovation; a main science and technology system reform framework has been basically established, substantive breakthroughs have been made in the key fields of enterprise innovation policy, planned funds management, science and technology results industrialization and income distribution system reform, and there has been a further strengthening of research personnel's sense of gain; and China's international standing in science, technology and innovation has been rising continuously.

In 2016, China's gross R&D expenditure reached RMB1.55 trillion, accounting for 2.1% of its GDP, with enterprises contributing to 78% of the total R&D expenditure. For 6 consecutive years, China has ranked 2<sup>nd</sup> in the world in terms of international research papers published and has rose to 4<sup>th</sup> place in the world in terms of SCI-indexed paper citations. So far, China has approved a total of 17 national independent innovation demonstration zones and 156 national hi-tech development zones, giving full play to their role in leading and driving regional economic and social development.

China attaches great importance to international cooperation in science, technology and innovation. In May this year, the Chinese Ministry of Science and Technology issued the *Thirteenth Five-Year Special Plan for International Cooperation in Science, Technology and Innovation*, setting the development goal of further deepening cooperation in science, technology and innovation with other countries and helping to build new international relations centering on win-win cooperation. In the next 5 years, China will continue to step up its opening-up to and cooperation with the outside world and build wider partnerships for science, technology and innovation with the rest of the world, including other BRICS countries.

Ladies and gentlemen, friends,

The world economy is now on a tortuous path to recovery through deep adjustment. It is in a critical period of functional change from the old to the new. A new round of science and technology revolution and industrial change is poised to take place. Mankind is entering a period of active and intensive science, technology and innovation. This provides us with rare opportunities and challenges for deepening cooperation in science, technology and innovation. The BRIC countries have their respective advantages in the areas of accumulated talents, theories and practices of science, technology and innovation, material and financial resources for science, technology and innovation, and geographical distributions across the globe. There is huge potential for their linked development. Overall planning and consultations in science, technology and innovation, cooperation and co-implementation of planned projects, and prompt sharing of project results between the BRICS countries will boost the growth mode transformation and upgrading, support and lead economic and social development in all 5 countries and provide new impetus for global economic growth. Meanwhile, these will also give a greater say to the BRICS countries and even all developing countries in global science, technology and innovation, as well as in political, economic, cultural and many other fields.

Innovation drives development, and cooperation leads the future. The BRICS countries share the same fate with each other and are both a community of shared interests whose members go forward hand in hand and a closely connected community of common destiny. In May this year, China successfully held the Belt and Road Forum for International Cooperation. In his keynote speech, Chinese President Xi Jinping stressed the need to adhere to the Silk Road spirit which centers on peaceful cooperation, openness and inclusiveness, mutual learning, mutual benefit and win-win cooperation, to work together to promote the construction of the Belt and Road, build the Belt and Road into a belt and road of peace, prosperity, openness, innovation and civilization Road, and march towards a better tomorrow. President Xi Jinping pointed out that it is necessary to adhere to innovation-driven development and build a digital Silk Road of the 21<sup>st</sup> century. He called for pushing forward the deep integration of science and technology with industry and with finance so as to create entrepreneurship space and workshops for young people of all countries in the Internet age, as well as for efforts to put the new concept of green

development into practice and achieve the 2030 Sustainable Development Goals together. At the recently concluded 2017 G20 Summit and the BRICS Leader's Informal Meeting held during the Summit, the BRICS countries reached important consensus on strengthening unity and cooperation, working together to build an open world economy, improving global economic governance and promoting sustainable development. All these are highly consistent with the idea of cooperation under the BRICS mechanism. China will uphold the BRICS spirit of openness, inclusiveness, cooperation and win-win cooperation, work with other countries and make joint efforts to plan a new BRICS development blueprint and write a new chapter of cooperation in science, technology and innovation between the BRICS countries.

As an old Chinese proverb puts it, "Even mountains and seas cannot distance people with common aspirations". Though far apart, the BRICS countries share the same aspirations and no mountains or seas can limit their cooperation. As long as we think about and work on the same goal, BRICS cooperation in science, technology and innovation will surely open a better tomorrow and usher in the next "golden three years".

Finally, I wish the meeting a complete success, and all our friends smooth work, happy living and good health during your stay in Hangzhou! Thank you!

July 18<sup>th</sup> 2017

(Dr. WAN Gang is Vice Chairman of the CPPCC National Committee, Minister of Science and Technology of China, and President of China Association for Science and Technology )

---

# I General Reports

---

## **Chapter1 Forecast and Evaluation of Innovation Capabilities & Review of STI Cooperation of BRICS**

Innovation is the primary driving force of human development and plays a critical role in promoting healthy economic development, accelerating institutional reform, upgrading both productivity and competitiveness, and addressing global challenges. BRICS countries are major countries leading STI development in developing countries as well as a globally important STI force. We evaluate the comprehensive innovation competitiveness of BRICS countries for 2001-2016 according to the model of national comprehensive innovation competitiveness indexes so to better inform 2017 BRICS Summit when China being as the rotating presidency of 2017.

### **Changes in the ranking:**

From 2001 to 2016, Brazil, India and China have risen in their ranking in terms of national comprehensive innovation competitiveness; the ranking of Russia and South Africa remained same.

### **Forecast on the STI competitiveness of BRICS countries:**

The average score of innovation index of each BRICS country would be on the rise for 2017-2025 as the overall national innovation competitiveness of BRICS countries would be constantly strengthened over time. It is predicted that the innovation competitiveness of India would see a significant rise with its growth rate probably surpassing China between 2025-2030; the growth rate of Russia would fall and India would take over Russia in terms of its comprehensive STI competitiveness by 2030 .

---

## **Status-quo of STI cooperation among BRICS countries**

Recent years China has extensively conducted practical cooperation with other BRICS countries through bilateral STI projects, joint STI bases and people to people exchanges, which has generated remarkable successes. The multilateral STI cooperation among BRICS countries has just been in place and not yet generated substantive collaboration. China's STI collaboration with other four BRICS countries features rich contents, significant achievements and great potential through international STI joint projects, joint STI bases and STI/people to people exchanges.

## **Problems and Suggestions**

The international community lacks an in-depth strategic study on international collaboration among BRICS countries. It is urgent to set up a regular network for technology collaboration and transfer as both the governments and a regularly organized conference on technology transfer could no longer satisfy the needs for the transfer and flow of technology, funding and talents under new circumstances. Therefore, the suggestions are proposed as follows:

- Strengthening coordination and overall planning.
- Intensifying joint STI efforts.
- Expanding people-to-people exchanges.
- Establishing a platform for technology transfer so to share the cooperation successes.
- Exercising influence of BRICS countries.
- Matching development strategies.
- Enhancing collaboration in basic research and mega scientific and engineering projects.
- Establishing a enterprises-oriented STI collaboration mechanism with a well functioned industry-academia-research chain.

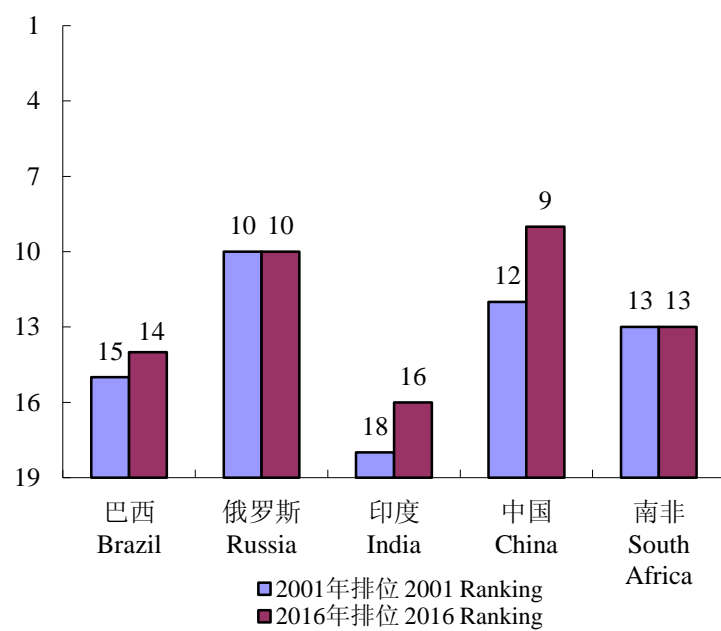


Fig. 1-1 Changes in ranking of BRICS countries in terms of their national comprehensive innovation competitiveness (2001-2016)



---

## **Chapter 2 S&T Priorities for BRICS Countries: In Search of a Win-win Strategy**

During the last few years Russia and other BRICS countries have significantly stepped up international aspect of their S&T and innovation policies, which made a tangible contribution to implementing their competitive advantages. A number of fundamental documents such as the Moscow Declaration on BRICS Countries' S&T Cooperation approved by BRICS science, technology and innovation ministers in 2015, and the BRICS Science, Technology and Innovation Work Plan for 2015-2018 play a major role in promoting international activities. This section presents an analysis of BRICS countries' S&T development potential and their possible interest in stepping up international cooperation, suggests approaches to identifying a system of priorities for BRICS countries' S&T cooperation, and relevant tools for implementing these priorities.

### **BRICS countries' R&D resources**

We take data on R&D indicators in BRICS from the world's largest database on science, technology and innovation indicators. As the end of June 2017, Scopus indexed more than 68.1 mln documents. China is a major economic and scientific power. Its internal R&D expenditures (GERD) are three times higher than combined expenditures of all other BRICS countries. In terms of R&D expenditures per researcher (in full-time employment equivalent) Russia has the lowest figure among BRICS countries, at \$80– \$90 thousand (PPP) during the last 5 years. In other BRICS nations relevant figures in recent years were between \$200–\$250 thousand.

### **BRICS countries' publication activity**

In 2000–2015, the number of publications by Chinese authors grew 8.5 times, while the overall growth rate of global publication activity during the last five years has declined. Generally, in 2015 BRICS countries produced almost 29% of the world's total number of Scopus-indexed publications; out of that, China's share was 18%, India's - 5%, Russia's and Brazil's – 2.6% each, and South Africa's – 0.72%.

---

## **Structure of BRICS countries' publications**

Structures of publications by BRICS countries' scientists were assessed using 27 major subject areas of the SCOPUS database, and compared with the global publication structure to calculate the countries Relative Comparative Advantages Index (RCA index).

Russian research sector has a predominantly “physics and technology” profile whose origins go back to the Soviet period. The subject area with the highest presence of Russian researchers (Scopus-indexed publications in 2011–2015) was Physics and Astronomy - 33,4% of all Russian publications.

## **International cooperation of BRICS countries**

South Africa shows the most active involvement in international research cooperation among all BRICS countries. In Russia the share of internationally co-authored publications for the last 15 years remained at 25-35%. The share of internationally co-authored publications by Brazilian researchers has grown during the last 5 years (from 23.9 to 30.1%). In India and China scientists are integrated into international research cooperation to a lesser extent than in other BRICS countries.

BRICS countries' involvement in international research cooperation (except South Africa) is much lower than European countries'. At the same time Asian countries with advanced research systems tend to display rather low participation in international scientific cooperation.

## **Setting priorities for BRICS countries' cooperation**

Priorities for BRICS countries S&T cooperation can be subdivided into thematic and functional ones. Thematic priorities comprise the most important R&D areas (such as ICT, space systems, etc.), investing in which could produce the highest social and/or economic effects in the medium to long term. Functional priorities include objectives aimed at facilitating development and performance of national research and innovation systems, e.g. accelerated development of human potential, commercialisation of R&D results, etc. Joint implementation of such projects would help accomplish major socio-economic objectives.

## **BRICS countries' cooperation: the current state and potential prospects**

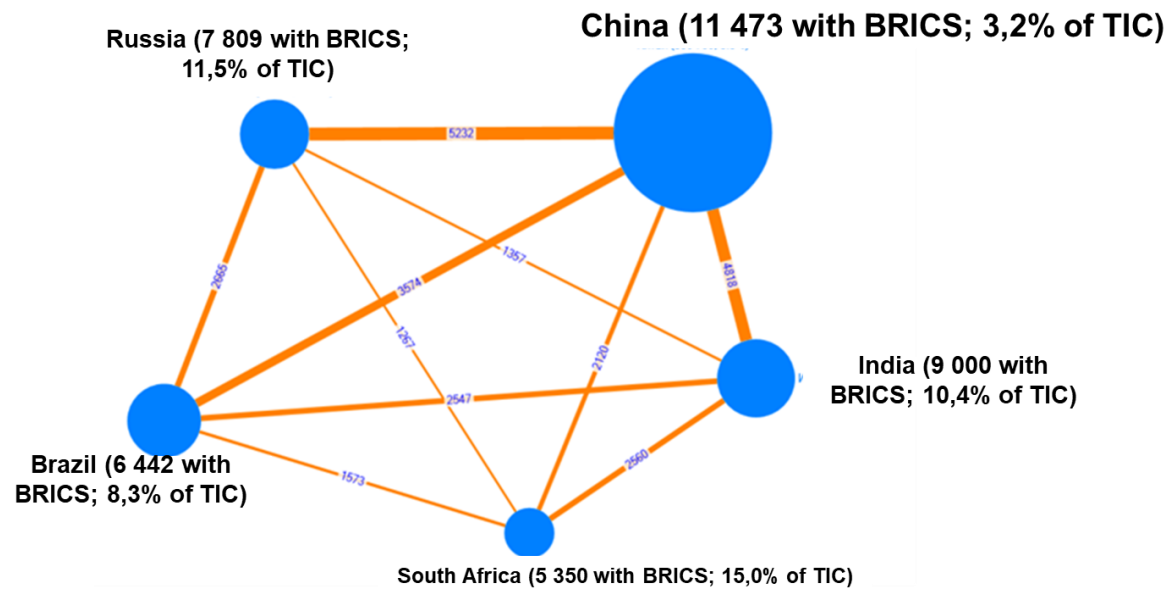
---

In terms of internationally co-authored publications by BRICS countries' scientists China is the leader: the number of such publications by Chinese authors grew from 7.8 thousand in 2000 to 88.7 thousand in 2015. In Russia, Brazil, and India the number of such publications was several times smaller – 20.3 thousand, 18.9 thousand, and 16.0 thousand in 2015, respectively. South Africa's figure was smaller still, at just 8.2 thousand publications in 2015.

BRICS countries' international cooperation has a significant development potential. The share of Chinese publications co-authored with researchers from BRICS countries in the total number of internationally co-authored publications is just 3%; for Brazil the relevant figure is 9%, for Russia – 10%, for India - 11%, and for South Africa - 15%.

#### **Analysis of BRICS countries' national, bilateral, and multilateral strategic and forecasting documents**

More than 90 national, and 20 bilateral and multilateral strategic and forecasting documents adopted by BRICS countries were analysed. In 2015 in Moscow, BRICS education and science ministers signed the Moscow Declaration on BRICS Countries' S&T Cooperation which outlined the main areas for future cooperation and various tools for supporting it, including setting up work groups on major research infrastructures; funding multilateral research projects; technology commercialisation; and innovation.



**Fig. 2. Map of intra-BRICS collaboration (Scopus-indexed publications, 2011 – 2015)**

---

## II Country Reports

---

### **Chapter 3 Brazil Report on Science, Technology and Innovation**

In the report we gave an account of the basic situation of science & technology innovation in Brazil, the status quo of Brazil and China's bilateral cooperation, and finally offered suggestions on advancing bilateral cooperation on science & technology innovation.

#### **Basic Situation of Science & Technology Innovation in Brazil**

From the changes in general rankings, Brazil ranked the 3rd among the BRICS for national innovative competitiveness. Compared with 2001, the ranking went one place up. In 2007, the ranking rose to the 3rd place and only dropped to the 4th in 2013. Generally speaking, the trend is upward with some fluctuation within the period of appraisal. According to the forecast, the general innovation index of Brazil is expected to grow from 26.59 to 28.22 in 2016-2020.

#### **National Strategy on Science & Technology Innovation**

Since the beginning of the 21st century, the Brazilian government has rolled out several four-year strategic development plans on science & technology. The National Strategy on Science & Technology Innovation (2016-2019) (hereinafter referred to as the "Strategy") was published in May 2016.

#### **Policy Incentives for Innovation and Entrepreneurship**

- Improving laws and regulations to encourage entrepreneurship among researchers.

- Capitalizing financial policies to support entrepreneurship among SMEs and micro businesses.

- Supporting SMEs and micro firms' startup & innovation initiatives with research funds

#### **R&D Spending, Output and S&T Personnel**

---

Brazil's R&D spending has increased at an annual rate of 16% since 2007 and reached 54.93 billion reais in 2012, but the corresponding proportion of R&D spending to GDP has only edged up from 1.11% to 1.24%.

### **Operating Model of Technology Transfer Institutions**

In order to promote integration of science and technology with socioeconomic development and further build the national technology transfer system, the Brazilian government has released or amended relevant laws over the past 10 years, initiating diversified financial services, building and perfecting technology transfer platforms, and encouraging independent construction of R&D and technology transfer centers to perfect the nation's industry-university-research cooperative mechanisms as well as science and technology innovation system.

### **Developments of S&T Innovation in Key Areas**

Brazil has achieved notable progress from the policies of S&T innovation, consolidating the foundation of human resources in various fields while expanding infrastructure of R&D innovation to enhance capabilities of S&T development in key areas.

## **Cooperation with China in S&T Innovation**

### **Status Quo of STI Cooperation between the Two Countries**

In 2004, the two countries released the MOU on establishing the high-level coordination and cooperation commission. At the moment, the main mechanisms of cooperation between China and Brazil in S&T innovation are as follows:

### **Main Difficulties and Barriers in the Course of Cooperation**

The cooperation in S&T innovation is substantially subjected to objective conditions. The political instability in Brazil in recent years and the high financial deficit combined to hinder the deepening of cooperation in S&T innovation. There has not been a stable, bilateral intergovernmental joint funding mechanism between China and Brazil.

---

## Chapter 4 Russia Report on Science, Technology and Innovation

Basic scientific research, which is traditionally an area of strength for Russia, has not only preserved its position as the foundation of national science and technology development but also become more competitive globally. According to the international rankings of innovation countries released by Bloomberg in late January 2016, Russia jumped to the 12<sup>th</sup> position, and this upward trend was further consolidated during the year.

### Overview of STI development

Russia got 24.21 points in national innovative competitiveness in 2015, which is 3.00 points lower than the best-performing BRICS country and 2.22 points higher than average. In terms of forecast, excluding the impact of economic factors, Russia's performance in comprehensive innovative competitiveness is expected to see a certain amount of growth during 2016-2020.

### STI Policies, strategies and development plans

On December 1 2016, Russian issued the *Strategy for Science and Technology Development of the Russian Federation*. The key purpose of the "strategy" is to clarify the objectives, strategic direction, key areas and development prospects of the country's science and technology in the medium-to-long-term, set out the basic principles, main contents and safeguard measures of the national science and technology policy, lay out the implementation steps and assess the expected results to ensure Russia's long-term, sustainable, rapid and balanced development.

### Policies for innovation and entrepreneurship

The separation between scientific research and industrial development, which has been formed under a deep-rooted planned economy, has made it difficult for Russia to translate its strong scientific research capability into real productivity.

- Building the operation system and platforms for cooperation
- Lifting restrictions on research institutes and higher learning institutions to run business
- Cultivating an innovation-friendly culture
- Fostering a policy environment friendly to business innovation

---

-Setting up motivation schemes to promote innovation in scientific research institutions

## **STI Cooperation with China**

### **Overview of China-Russia Science and Technology Cooperation Projects**

The total number of projects between 2007 and 2015 stood at 600, with a total investment of RMB2.6 billion. From the time point of view, the number of projects and funding levels were on a growing trend year by year. In terms of the geographical distribution of project implementation organizations, the organizations were from 30 provinces (autonomous regions and municipalities) in China, with Beijing undertaking the largest number of projects, at 116 or 19% of the total.

### **Difficulties and Obstacles in China-Russia Cooperation in Science, technology and innovation**

-China and Russia need to further strengthen their cooperation in major projects of science, technology and innovation.

-China and Russia still need to fully establish efficient channels of technology transfer.



---

## **Chapter 5 Overview of Science, Technology and Innovation**

### **Development in Russia**

The Russian Federation faces a variety of challenges in securing adequate investment in new knowledge and technologies and deriving socio-economic benefit from them. The rapid growth of the Russian economy since the turn of the century had been largely fuelled by oil, natural gas and other primary products.

### **Introduction**

#### **The task of transition to the innovative growth pattern**

Paradoxically, the rapid economic growth fuelled by the commodities boom between 2000 and 2008 actually weakened the motivation of enterprises to modernize and innovate. Another factor – the preservation of not very favorable conditions for entrepreneurship and for innovative entrepreneurship in particular. For instance, public research institutes and universities received grants to enable them to invite top Russian and foreign professionals to work on their campuses.

#### **The course towards a new economy**

The domestic weaknesses observed in recent years include inadequate intellectual property protection, the obsolete institutional structure of the R&D sector, the lack of autonomy of universities and the relatively weak infrastructure for research and innovation. In 2016, the *Strategy of Science and Technology Development towards 2035* was developed and adopted. A new law regulating STI activities and policies is being finalised.

#### **A new agenda for government policy**

In May 2012, the president approved several decrees proposing directives for STI development. These decrees fix qualitative objectives that are to be measured against quantitative targets to 2018.

#### **Preservation of the traditional budget-oriented model of science funding**

Gross domestic expenditure on research and development (GERD) in Russia rose by 2 times at constant prices from 2000 to 2015; federal budget allocations for

---

civil R&D –even 4 times. Nevertheless, Russia’s R&D intensity remained relatively stable; in 2015, GERD accounted for 1.13% of GDP, compared to 1.25% in 2009.

### **Priorities of innovation activity**

In the course of its transition to a market economy Russia has become an attractive destination for foreign technologies. Between 2009 and 2015, the number of patent applications submitted in Russia by foreign applicants increased 3 times – 16 248 units. Intellectual property titles represent only roughly 6% of technology exports and only few companies engaged in R&D got revenue from exports of technology.

### **Human Resources**

#### **The structure of S&T personnel**

Although Russia ranks 43th in the latest Global Innovation Index and 23th in the sub-index for human capital development (GII, 2016), international competition for talent is intensifying. The issue of developing skills and behavioural patterns in line with the country’s development strategy has never been more pressing in Russia. Policies introduced in recent years have addressed this urgent question.

#### **A serious change in the remuneration system of researchers**

In 2012–2013, several roadmaps were adopted to improve the attractiveness of careers in research, in order to stimulate productivity, redress the age pyramid and give research a greater economic impact. The action plan fixes the target of raising researchers’ salaries to at least 200% of the average wage in the region where the researcher is based by 2018.

#### **Holders of university degrees**

Russia has long had a relatively high level of education. In recent years, interest in pursuing higher education has not waned. On the contrary, a Russian could expect to spend 15.7 years in the education system in 2013, up from 13.9 years in 2000.

#### **Training scientists becoming a core mission of research universities**

As of the 2013/2014 academic year, 5.6 million students were enrolled in the

---

country's tertiary institutions, 84% of which were state-owned: 2.8% of students were studying natural sciences, physics and mathematics; more than 20% engineering; 31% economics and management; and a further 20% humanities.

### **High level of university research – a top priority for the Government**

Russia's higher education sector has a long-standing research tradition that dates back to the Soviet Union. Boosting support for university research has become one of the most important strategic orientations of STI and education policies in Russia.

### **STI Governance**

#### **Higher education must adapt to economic needs**

Despite undeniable success in boosting university research in recent years, one urgent problem remains: the discrepancy between the structure and quality of professional training, on the one hand, and current economic needs, on the other.

#### **Joining the Bologna Process**

New legislation has raised the standards for a PhD and made the process more transparent. University consortia and networking have been introduced into educational curricula and universities have been given the right to set up small innovative firms to commercialize their intellectual property. Students may also apply for scholarships or earmarked loans to cover the costs of their education.

#### **New funding mechanisms**

The 5/100 Programme was adopted in 2013 to raise the global competitiveness of Russian universities to the point where five of them figure in the top 100 (hence the programme's name) and the remainder in the top 200 of global university rankings.

#### **Incentives for business**

Since 2010, the government has also introduced a number of schemes to stimulate innovation in the business sector.

#### **The problems in the field of patent activities**

The national intellectual property market is still at the developmental stage,

---

with research output taking years to influence the economy: only 2–3% of all current patents are in use and patenting tends to be done more intensively than licensing of intellectual property.

### **Tax instruments for R&D and innovation**

All fiscal affairs have been governed by a single document since 2008, the Russian Tax Code. The most important amendments in recent years concern new rules for calculating R&D expenditure and classifying certain specific types of spending by organizations as R&D expenditure, along with new regulations on the creation of reserves for forthcoming expenditure.

### **Institutional reforms**

The institutional structure of the Russian R&D sector is not yet fully adapted to the market economy. Unaffiliated research institutes and design bureaux tend to dominate institutions of higher education and enterprises when it comes to R&D: they represented 48% and 9% of all R&D units respectively and employed three-quarters of all R&D personnel in 2015. Industrial enterprises account for just 7.4% of all R&D units, compared to 18% for institutions offering higher education .

### **R&D priorities and critical technologies**

Russia has an established system for identifying priorities so that resources can be distributed effectively to a limited number of fields, taking into account national objectives and both internal and external challenges.

### **Developing technologies to ‘shrink’ distances**

The development of transport systems has two key motivations: to strengthen the global reach of domestic technologies and ensure continuity across Russia’s vast territory through the development of regional aviation hubs and high-speed railways.

### **Alternative energy and energy efficiency**

Given the energy sector’s key contribution to GDP and exports, any changes have an immediate impact on national competitiveness.

### **Innovative territorial clusters**

In 2012, Russia launched a series of pilot innovative territorial clusters to

---

promote value-added production chains and drive growth in the regions.

### **Technology platforms and engineering centres**

The first technology platforms were set up in Russia in 2010. They serve as a communication tool to unite the efforts by the state, businesses and the scientific communities to identify challenges, develop strategic research programmes and implementation mechanisms and encourage promising commercial technologies, new goods and services in specific economic sectors.

### **Trends in International Co-operation**

STI Cooperation with BRICS Countries. The reforms implemented in Russia include a serious ‘rationale’ for partnerships with foreign countries, such as with the fellow BRICS countries, Brazil, India, China and South Africa, as well as other rapidly developing nations.

---

## **Chapter 6 India Report on Science, Technology and Innovation**

### **Basic Situation**

As for the change in overall rankings, India came 5<sup>th</sup> among the BRICS countries in terms of national Innovative competitiveness in 2015, same as its ranking in 2001. In 2010, India rose to 4<sup>th</sup> place but later fell back to 5<sup>th</sup> position. Overall, the rankings fluctuated during the evaluation period. According to the forecast, India's innovation index score will rise year by year, expecting to reach 26.79 points by 2020.

### **TI Policy, Strategy and Development Plans**

The science and technology management system of India mainly consists 2 levels, the central government level and the state government level. Social, economic and other departments of the central government. Some industrials and economic departments in the central government of India are also involved in science and technology work.

### **Science and Technology Development Plans**

Since 1957, India has been formulating its national development strategies taking China's Five-Year plan as a reference. India's current Twelfth Five-Year Plan (2012-2017) has set specific development goals for the science and technology sector, specifying R&D inputs, science and technology output, talent training and other indicators.

### **Innovation and Entrepreneurship Support Policy and Practice**

To address the problem of the commercialization of science and technology results obtained by State research institutions and universities, MOST, the Ministry of New and Renewable Energy, and the Ministry of Commerce and Industry of China have gradually formulated guiding advices on the research results of public-funded science and technology programs and research projects.

- MOST has introduced several policies and provisions on the industrialization of publicly financed science and technology results

- The Ministry of Commerce and Industry has submitted for deliberation A Motion on The Protection and Application of Publicly Financed Intellectual Property Rights, the Indian version of the Bayh-Dole Act

- The Ministry of New and Renewable Energy has set out provisions on the intellectual

---

property rights protection obligations and income distribution of research institutions.

-“Startup India, Standup India” has made achievements

## **International Cooperation**

India’s strategy for international cooperation in science and technology is to strategically select major powers of science and technology output, focus on international alliance and partnership building and fully leverage advantages of international cooperation. India attaches importance to expanding channels of science and technology cooperation and has greatly increased its international bilateral science and technology cooperation activities.

## **China-India STI Cooperation**

### **Current Status**

-Mechanisms and platforms preliminarily established.

-Fields of cooperation and exchanges have continued to expand.

-Multilateral cooperation under the BRICS framework

-China-India Software Industry Park has become a model of China-India STI cooperation.

### **Difficulties and Obstacles**

-That there is a lack of trust between China and India in their cooperation in science and technology has hampered the progress of the cooperation.

-Mechanisms for bilateral cooperation in science and technology are not adequate, resulting in mediocre operational performance.

-Science and technology cooperation has not produced notable results, and there is still potential for cooperation.

-Insufficient information exchanges makes projects difficult to implement.

---

## **Chapter 7 China Report on Science, Technology and Innovation**

Since reform and opening-up, China's economy has maintained rapid growth over the long term. This section will focus on detailed analysis of China's national innovative competitiveness and the changes in the ranking of the BRICS in the 20 years from 2001 to 2020. From the comprehensive ranking, China's ranks first in terms of national innovative competitiveness in the BRICS in 2015, one place up compared with that of 2001. In terms of forecasting, China's comprehensive innovation index is expected to achieve rapid growth from 2016 to 2021 with an increase by 16.43 points and the annual growth rate will exceed 5.1%.

### **Overview of China's Science, Technology and Innovation**

Since the 12th Five Years and the 18<sup>th</sup> CPC National Congress in particular, the central leadership has been attaching great importance to science, technology and innovation (STI). Important decisions were made on the implementation of the innovation-driven development strategy. A new round of global scientific and technological revolution and industrial transformation has taken shape. And China's economic development has entered a new normal. The 13th Five-Year National Plan on STI notes that the supply-side reform should be promoted to enhance the quality and efficiency of economic transition and upgrade. That presents an urgent need to leverage STI to create new drivers for growth.

### **Status quo of STI in China**

-R&D intensity has again reached a record high. State finance and taxation have played a bigger role in supporting STI.

-Capabilities of original innovation have been continuously improved with significant R&D achievements.

- Science, technology and innovation have optimized the industrial structure and supported economic and social development.

-Regional innovation witnesses new strides and remarkable progress in some



---

areas

### **China's cooperation with BRICS members in science and innovation**

With BRICS cooperation constantly furthered, a multi-domain and multi-tiered cooperation mechanism where BRICS Summit plays the leading role and hi-level meetings in relevant departments and areas serve as the supplement. In terms of cooperation mechanism, STI cooperation under BRICS framework contains three tiers of working mechanisms, namely ministerial meeting, coordinators' meeting and working group meeting.

China and the other four BRICS countries have conducted content-rich, fruitful and promising STI cooperation in international S&T cooperation project, bases and exchange of research personnel.

### **Outcome of cooperation with BRICS countries**

- Tackle key technologies in priority areas and enhance innovation capacity of BRICS countries

- Further BRICS Partnership through personnel exchange

- BRICS STI cooperation becomes role model of cooperation between developing countries

---

## **Chapter 8 South Africa Report on Science, Technology and Innovation**

### **The Landscape of Science, Technology and Innovation in South Africa**

In terms of overall ranking of national innovation competitiveness, South Africa ranked 4<sup>th</sup> in “BRICS” countries in 2015. In forecast, South Africa’s Composite Innovation Index will score low in the long run, which is expected to increase by only 0.26 points from 2016 to 2020.

#### **Science, Technology and Innovation Policy, Strategy and Development Plan**

The overall goal of scientific and technological innovation in South Africa is to serve the economic and social development and build a knowledge-based economy and society.

- Value Science, Technology and Innovation, and Build a Long-term Strategy of National Economic and Social Development

- Focus on Sharing Research Platforms in order to Back up the Construction of National Innovation System

- Take Multiple Measures to Give Full Play to the Main role of Enterprises in Innovation

- Strengthen Industrial Technology Innovation to Promote Economic and Social Development

- Introduce International Talent to Make up for Talent Shortage in Key Areas

#### **Strategy for the Development of Key Areas of Technological Innovation**

- Introduce the Research Infrastructure Roadmap to Vigorously Develop the Research Infrastructure Focusing on SKA Mega-science Projects

- Establish State-owned Enterprises and R&D Centers to Vigorously Promote the Development of the Pharmaceutical, Bio-economy and Other High-tech Industry

- Launch a Number of Projects and Programs to Develop the Advanced Manufacturing Industry

---

-Develop the National Strategy of Astronomy and Lead the Development of African Space Policy and Strategy

-Launch the Marine Economic Forum and Promote the Development of Marine Economy

### **Favourable Innovation and Entrepreneurship Policies**

-Establish the Technology Innovation Agency to Manage National Technology Innovation and Transfer.

-Set up Relevant Funds and S&T Programs to Support R&D Innovation and Technology Transfer.

-Improve the Innovation and Technology Service System, and Set up a Platform for Incubation and Technology Transfer.

-Emphasize on the Management of Intellectual Property and Support the Transfer of Technology through Policies and Regulations.

### **International Scientific and Technological Cooperation**

-South Africa increases cooperation with multinational companies.

-South Africa attracts international high-end scientific and technological personnel through research chairs initiative.

-Make the Science Forum South Africa (SFSA) a world-renowned conference to widen international cooperation.

### **STI Cooperation with China**

China and South Africa are both global emerging economies, and members of the BRIC countries. In order to promote scientific and technological cooperation and development, the two governments signed the Agreement on Science and Technology Cooperation between China and South Africa and established the China-South Africa Joint Committee on Intergovernmental Cooperation in Science and Technology. Under the agreement, the two countries' science and technology departments have set up a "China-South Africa Joint Research Program". Each year the funding goes to no more than 15 projects and 74 joint cooperation projects were

---

co-financed in total.

---

## III Thematic Reports

---

### Chapter 9 Study on Digital Technology in BRICS

During the 2016 BRICS Summit in Goa, India, strengthening exchanges and cooperation in digital economy among the BRICS countries was first proposed and the ICT Development Agenda and Action Plan were passed. Later, China, which assumed the rotating presidency of 2017 BRICS Summit, initiated that the priority be put on the establishment of a digital experience sharing mechanism and the development of digital economy. China proposed the formulation of supporting policies, the investment on digital economy and the promotion of experience sharing so that people can share benefits from the development of digital economy, and new impetus can be given to the economic development in BRICS countries. The digital economy in BRICS countries is still at the initial stage, enjoying great development potential and prospects.

#### **The Connotation and Characteristics of Digital Economy**

The digital economy is also called the Internet economy, the Information Economy or the New Economy. The G20 2016 Summit made a comprehensive definition so far, that is, the digital economy refers to a broad range of economic activities that include using digitized information and knowledge as the key factor for production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT) as an important driver of productivity growth and economical structural optimization.

#### **Development Trend of Digital Economy**

-Digital Technology Development Has Changed the Foundation of Economic Innovation

-Redefinition of Innovation in Digital Technology Application

-Mobile Network Created New Modes and Formats

-The Content of Digital Technology Innovative Education

#### **Status Analysis on the Innovative Development of Digital Economy in BRICS**

---

According to its statistics and prediction, the average share of BRICS Internet economy in GDP was 3.1% in 2010, and the ratio was expected to rise up to 4.0% in 2016. According to *The Global Information Technology Report 2016* published by World Economy Forum, the ranking of networked Readiness Index (NRI) shows that the BRICS countries are climbing up in the past ten years, but the development in recent two years is quite disappointing. Part of the reason is that, there are deep-rooted gap between different income groups in terms of digital broadband access, digital literacy and services acceptance, a large number of people are unable to participate in the rapid development of digital economy.

#### **Key Areas of Innovative Development of BRICS Digital Economy**

- Promoting Innovation and Infrastructure Construction of Information Communication Enabling Technology

- Expanding and Strengthening Digital Economic Development Potential

- Promoting E-Government Development

- Strengthening Network Security Management Cooperation

#### **Strategies to Improve Innovative Development of Digital Economy of BRICS Countries**

- Strengthening Strategic Coordination of Digital Economy Development of BRICS Countries

- Developing Inclusive Digital Economy

- Emphasizing the Cultivation of Digital Talents

---

## **Chapter 10 Study on Technologies for Financial Inclusion in BRICS**

The BRICS has carried out the beneficial exploration and practice in strategic policy and system design, business mode of financial institutions, application of information technology and consumer financial education and so on, but the various countries has taken different development model. China, India and Brazil emphasize on providing financial services to more poverty stricken population and plan to lead the poor and low-income groups to participate in the financial activities via more means of commercialization, marketization on the basis of widespread financial and non-financial institutions and developed scientific and technological level. In South Africa, the black are still at a disadvantage compared to the white due to discrimination against the black race. Therefore, South Africa considers race, culture and other factors as important factors in the process of exploring the model of financial development. The development of the Russian financial system is relatively good, and the microfinance business is stable and mature. It is more focused on promoting the construction of the software facilities of inclusive finance such as education and personnel training and so on.

In addition, there is a big gap between developing countries and developed countries in inclusive finance. Due to differences in economic level and financial infrastructure, focuses are different in constructing the inclusive financial system. Developed countries have high economic level and good social welfare. Diversified and multi-level financial institutions can meet the needs of all kinds of customers. Therefore, the government pays more attention to regulating and perfecting the system and laws in the process of promoting inclusive finance, thus guaranteeing the coverage and expansion of financial services. On the contrary, developing countries have lower level of economy and deficiency in the financial system. Remote areas and vulnerable groups are lack of financial services. Thus, business model and innovative design of products should be paid more attention to. In addition, we should also recognize that development of financial inclusion not only depends on the financial sector itself, but also needs effective coordination and support from

---

departments of education, law and finance. Only this way can we promote the financial order and healthy development of financial inclusion.

In recent years, the BRICS countries have pursued rapid economic growth while focusing more on the inclusive and sustainable development of economy and finance. At present, the BRICS countries have reached a consensus on the implementation of financial inclusion and strengthened international exchanges and cooperation to actively explore the development path of the financial inclusion. According to the data from Global Financial Inclusion Database of World Bank in 2014, the BRICS have made significant results in spreading financial services such as personal savings, credit and payment. More than 50 per cent of the population who are aged 15 or older have a financial account. Except for India, the proportion of net usage for payments or transactions have also reached more than 10 per cent, with China and South Africa developing faster in Internet payments or transactions. Moreover, the BRICS countries have also seen significant improvements in remittances, savings and credit services. However, compared with high-income countries, the financial penetration and popularity of BRICS countries still have a lot of room to improve, and there is still a long way to go in the development of inclusive finance.

Due to the large population size and rapid economic development, the BRICS countries have become increasingly important in international financial and economic activities. The development of the financial sector in the BRICS countries will also have a far-reaching impact on the development of global inclusive finance. In the future, digital technology will become an important driving force for the development of inclusive finance. At the 2016 G20 Hangzhou Summit, "focusing on digital inclusive finance" and "the construction of financial data collection and indicators" became important topics of this meeting. China submitted three important documents to the G20 Summit, including *G20 High-Level Principles for Digital Financial Inclusion*, *G20 Financial Inclusion Indicators* and the *G20 Action Plan on SME Financing*, which will provide important guidance for the development of global financial inclusion. Digital financial inclusion will integrate the Internet



---

technology with modern finance, using digital means to provide low cost, high efficiency of financial services for a broader area, a wider range of groups, to further improve the financial service's popularity and availability and to be an inevitable trend of each country in developing financial inclusion.

---

## **Chapter 11 Study on Energy Technology in BRICS**

China leads the BRICS countries in the field of energy science and technology. Russia, Brazil, India and South Africa have their own distinctive national conditions and advantages in energy and technology. The development of the energy and technology in BRICS countries in general, especially in the frontiers, however, still lags behind that of developed countries.

### **Research on Energy Science and Technology in China**

In the course of the development of China's energy utilization, it can be found that there are many variables at different stages that affect the evolution of the energy security system, and the variable that is the slowest in change and has the most far-reaching effect is science and technology. At present, in the field of energy, the important role of this slow variable, science and technological innovation is becoming increasingly prominent and has gradually become the "order parameter" of China's energy security system.

- China has made many achievements in energy science and technology

- STI is key to China's future energy security

### **Research on energy science and technology in Russia**

Russia, as the world's largest country in terms of area, has a wealth of energy. Its natural gas proven reserves amounts to 48 trillion cubic meters, accounting for 35% of the world and ranking the first; oil reserves of 10.9 billion tons, accounting for 13% of the world's proven reserves; coal reserves of 201.6 billion tons, ranking the second. Although Russia boasts rich energy reserves, its energy structure is relatively simple, oil and gas being the main energy. However, in the field of energy technology, Russia has not made big progress although its efforts have never faded, which not only enriched its energy types, but also provided impetus to the future development of energy in Russia.

### **Research on energy science and technology in Brazil**

Following the outbreak of the oil crisis in the 1970s, Brazil formulated energy diversification and new energy research & development strategies, with the energy sector becoming a top priority. In 2005, the Brazilian State Oil Company discovered

---

high quality crude oil in 1332-meter deep underwater 160 kilometers north of Rio de Janeiro. By 2006, Brazil's average daily output of oil reached 1.91 million barrels. The annual average growth of offshore oil production maintains at more than 10 percent, making it the third largest oil producer in Latin America. On the basis of consolidating traditional energy, Brazil treated clean energy as its own energy development strategy and put forward energy development plan stretching as far as 2030. Brazil plans to use clean energy as the main energy for industrial and civilian use that can replace gasoline. Clean energy includes electricity, wind, nuclear, hydro and bio energy, among which bio-energy is the strategic focus.

### **Research energy science and technology in India**

India is similar to China in many aspects. With large area and a huge population second only to China, the country's energy is mainly based on coal and oil. The population, GDP and development speed has rendered India one of the world's leading energy consuming powers. In recent years, India has been committed to the development of renewable energy in view of the high energy consumption and the wide application of technology in the energy sector. India's top priority is to adopt energy technology route through formulating proper energy policies. India will encourage the development of energy technologies that are close to commercialization and have a clear time schedule.

### **Research on Energy Science and Technology in South Africa**

South Africa has stronger energy industry foundation, and its technology is more advanced. South Africa's electricity sector is more developed; its power generation accounts for 2/3 of Africa's total; but about 92% of South Africa's electricity comes from thermal power. South Africa enjoys supports from domestic economy and advantages to attract foreign funds and technology. In the face of severe energy situation, thermal power relying on coal has clearly lost impetus; so on the future energy development path, South Africa should focus on developing and utilizing new energy.

---

## **Chapter 12 Study on Agricultural Technology in BRICS**

BRICS countries are endowed with rich agricultural resources and boast a large agricultural population. They feature prominently in global agricultural area. From 2010 to 2016, their gross farm production increased from 1.4 trillion dollars to 2.3 trillion dollars with their shares in global total climbing from 47% to 57%. Their grain production accounted for over 40% of the global total. The four countries use less than 30% of the national land to raise 43% of the global population. Agricultural trade within BRICS countries has grown rapidly. China's import and export of farm produce to other BRICS countries have increased by 50% and 23%, exceeding the global average of 14%. In recent years, agricultural modernization drive in BRICS countries has sped up with elevated agricultural level. However, global warming, frequent natural disasters, land and water shortage and increased global population have put pressure on the supply and demand of farm produce. Facing all this, BRICS agriculture is still facing the risk of declined grain producing capacity and unguaranteed food security.

The research report focuses on such development level of BRICS countries. Based on the national agricultural technology innovation system, evaluation indicators system and mathematics models set up by the research team, the report analyzes and evaluates the agricultural technology innovation capacity of BRICS countries from 2001 to 2016 in a comprehensive, in-depth and scientific way, which reveals the features and differences among countries, identifies their comparative advantages and weak points, tracks their development trajectory and ways for improvement and provides valuable theories and solutions for countries to enhance their agricultural technology innovation.

### **Evaluation of Agricultural Technology Innovation Capacity in BRICS Countries**

In overall ranking, from 2001 to 2016, Brazil and China have ranked higher, India has remained the same and Russia and South Africa have ranked lower. In 2016, China (10<sup>th</sup>) is the only one in the second tier. Brazil (11<sup>th</sup>), South Africa (13<sup>th</sup>)

---

and Russia (14<sup>th</sup>) were in the third tier. India (17<sup>th</sup>) was in the fourth tier.

### **Evaluation of Secondary Index of Agricultural Technology Innovation**

In terms of overall ranking of basic capacity of agricultural technology innovation, from 2001 to 2016, Brazil, China and Russia have remained the same. India and South Africa have decreased by one place. In 2016, China (10<sup>th</sup>) was the only one in the second tier. India (12<sup>th</sup>), South Africa (13<sup>th</sup>), Russia (14<sup>th</sup>) and Brazil (15<sup>th</sup>) were in the third tier.

### **Evaluation of Environmental Capacity of Agricultural Technology Innovation**

In terms of overall ranking of environmental capacity of agricultural technology innovation, from 2001 to 2016 India and Russia have climbed higher. China has remained stable. South Africa and Brazil have dropped. In 2016, Russia (10<sup>th</sup>) was the only one in the second tier. South Africa (11<sup>th</sup>), China (12<sup>th</sup>) and India (13<sup>th</sup>) were in the third tier. Brazil (16<sup>th</sup>) was in the fourth tier.

### **Evaluation of Production Capacity of Agricultural Technology Innovation**

In terms of overall ranking of production capacity of agricultural technology innovation, from 2001 to 2016 Brazil has climbed by five places. China and India have remained the same place. Russia and South Africa has dropped by 2 and 3 places. In 2016, Brazil (8<sup>th</sup>) was the only one in the second tier. South Africa (14<sup>th</sup>) was in the third tier. China (16<sup>th</sup>), Russia (17<sup>th</sup>) and India (19<sup>th</sup>) were in the fourth tier.

### **Report on Evaluation Result**

-Brazil's National Agricultural S&T Innovation Capability (NASTIC): Assessment and Analysis :in 2016 Brazil's national agricultural technology innovation capacity ranked 11<sup>th</sup> in G20 and in 2001 it ranked 13<sup>th</sup>. In general, the ranking has increased steadily during the evaluation period.

-China's National Agricultural S&T Innovation Capability (NASTIC): Assessment and Analysis:in 2016 China's national agricultural technology innovation capacity ranked 10<sup>th</sup> in G20 and in 2001 it ranked 11<sup>th</sup>. In general, the ranking has dropped and then climbed up during the evaluation period.

-India's National Agricultural S&T Innovation Capability (NASTIC):

---

Assessment and Analysis: in 2016 India's national agricultural technology innovation capacity ranked 17th in G20, which was the same as in 2001. In general, it has remained stable during the evaluation period.

-Russia's National Agricultural S&T Innovation Capability (NASTIC):  
Assessment and Analysis: in 2016, Russia ranked the 14th among the G20, 2 places down as compared with in 2001. 2011 witnessed the gravest drop. The ranking shows a downward trend with temporary fluctuation.

-South Africa's National Agricultural S&T Innovation Capability (NASTIC):  
Assessment and Analysis: in 2016, South Africa ranked the 13th among the G20, 3 places down as compared with in 2011. The ranking shows a downward trend with temporary fluctuation.

## **Conclusion**

In recent years, the BRICS have made remarkable progress in modern agriculture and their score of innovation capability of agricultural S&T show an upward trend. The BRICS are even taking the lead in certain indicators. For instance, in 2010, only South Africa ranked among the top 10 in agricultural production index while in 2016 all BRICS ranked among the top 10. The score gap between BRICS and agricultural powers have been narrowing on a yearly basis. However, BRICS still lag behind substantially in aspects including research, quality of education, modern infrastructure and eco-protection. The BRICS still enjoy huge space for improvement.

---

# IV Appendix

## **Appendix 1: Brief introduction of STI evaluating reports**

### **1.1 The Global Competitiveness Report of the World Economic Forum**

The World Economic Forum (WEF) started to launch the global competitiveness report since 1979. From 1997 to 1999, the overall ranking of competitiveness adopts the following eight secondary indicators: ① the openness of the economy to international finance and trade; ② government budget, tax and management; ③ the level of financial market development; ④ the quality of transportation, communication, energy and service-oriented infrastructure; ⑤ basic research, applied science and technology science; ⑥ corporate management; ⑦ labor market and its mobility; and ⑧ legal and political systems. Since 2000, WEF has made major adjustments to the index system of global competitiveness evaluation by increasing the proportion of the capability in S&T innovation. From 2001 to 2006, the Technology Indicator was used to determine the Innovation Index, and from 2006 to 2007 the Innovation and its Complexity was used for the ranking. The 2016-2017 Global Competitiveness Report, published in 2016, covers a total of 138 economies worldwide with data from the United Nations, World Bank, International Monetary Fund, and World Economic Forum. The evaluation indicators used in the report include: institutional building, infrastructure, macroeconomic environment, health and primary education, higher education and training, commodity market efficiency, labor market efficiency, financial market development, technology readiness, market size, business sophistication and innovation. The twelve indicators reflect the whole picture of the competitiveness of a country, thus becoming the main basis for evaluation.

### **1.2 The Global Innovation Index of INSEAD**

In 2007, INSEAD and the United Nations University worked together to complete the first Global Innovation Index, which has been released annually since then. The Global Innovation Index represents a comprehensive and quantifiable system of indicators that can be used to assess global innovation activities and the innovation capability of economies across the world, thus providing guidance for innovative practices in various countries and regions. The index report not only includes important indicators such as the proportion of R&D input in GDP and the number of patents and trademarks, but also covers diversified indicators such as infrastructure, business environment and human resources. The report aims at achieving depth and width of research as well as providing a new perspective to the global innovative activities. In addition, this index report uses not only objective, quantitative hard

---

indicators and comprehensive indicators, but also subjective, qualitative soft indicators and other research methods to ensure that the research results are accurate and scientific. The 2016 Global Innovation Index, which was jointly released by the World Intellectual Property Organization, Cornell University and INSEAD, ranked 128 countries and economies based on 82 indicators and explored the impact of innovation-oriented policies on economic growth and development.

### **1.3 Report on National Innovative Competitiveness Development of the Chinese Academy of Social Sciences and Fujian Normal University**

In 2011, the Chinese Academy of Social Sciences and Fujian Normal University jointly released the yellow book of the Group of Twenty (G20) National Innovative Competitiveness Development Report (2001-2010), presenting the evaluation of innovative competitiveness of the 20 countries from 2001 to 2010 year by year. Subsequently, they released the yellow papers of the Global Innovative Competitiveness Development Report (2001-2012), the G20 National Innovative Competitiveness Development Report (2011-2013), the G20 National Innovative Competitiveness Development Report (2013-2014), the G20 National Innovative Competitiveness Development Report (2015-2016), assessing the national Innovative Competitiveness of 100 countries and the Group of Twenty. The index system includes five secondary indicators (namely, basic innovative competitiveness, innovative environment competitiveness, innovative input competitiveness, innovative output competitiveness, and innovation sustainability competitiveness) and 32 tertiary indicators that are related to science and technology, economy, and education, etc.

### **1.4 Bloomberg Innovation Index**

In 2012, Bloomberg compiled the global innovation index TOP 50. Seven key indicators were used for the index, including R&D intensity, productivity, manufacturing capacity, high-tech density, higher education efficiency, concentration of researchers, and patent status. The data used for the indicators were mainly from the World Bank, the World Intellectual Property Organization, the Conference Board, the OECD and the UNESCO. In 2015, Bloomberg analyzed six indicators of 200 plus countries including R&D, manufacturing, high-tech companies, education, researchers and patents and published the ranking of world's top 50 countries in terms of comprehensive innovation capability. In 2016, the Bloomberg Innovation Index quantified and ranked the innovation capability of countries and regions based on seven comprehensive indicators (i.e. R&D intensity, industrial added value, productivity, high-tech density, higher education coverage, researcher concentration and patent activity).

### **1.5 National Innovation Index of the China Academy of Science and Technology Development (CASTED)**



---

Since 2011, the China Academy of Science and Technology Development (CASTED) started to release the annual National Innovation Index Report. The National Innovation Index Report 2013, which was published in 2014, measured the innovation index of 40 countries by the international common benchmarking method on the basis of statistics from 2011 to 2012. It has drawn on the latest research results on “national competitiveness” and “innovation evaluation” at home and abroad, and internationally authoritative evaluation reports done by the World Economic Forum and the International Institute for Management Development. The National Innovation Index Report 2015, published in 2016, re-evaluated the Innovation Index of 40 major countries in the world by five primary indicators, including innovative resources, knowledge creation, corporate innovation, innovation performance and innovation environment.

---

## **Appendix 2: Fundamental Documents Specifying the Framework of BRICS STI Cooperation**

*Theme: BRICS Science, Technology and Innovation Cooperation: A Strategic  
Partnership for Equitable Growth and Sustainable Development*



### **Cape Town Declaration**

**Cape Town, South Africa, 10 February 2014**

1. In line with the mandate of the eThekweni Declaration and Action Plan of March 2013 adopted at the Fifth BRICS Summit held in South Africa, we the Ministers and their representatives for Science, Technology and Innovation 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, met in Cape Town, South Africa for the First BRICS Science, Technology and Innovation Ministerial Meeting on 10 February 2014, to discuss and coordinate positions of mutual interest and identify future directions of institutionalizing cooperation in science, technology and innovation within the framework of BRICS.
2. We reaffirm the vision to strengthen the BRICS partnership for common development and advance cooperation in a gradual and pragmatic manner, reflecting the principles of openness, solidarity and mutual assistance, and give substance to all

---

the calls expressed at previous BRICS Summits to intensify cooperation in the spheres of science, technology and innovation, including the peaceful use of space.

3. We stress the paramount importance of science, technology and innovation for human development. Indeed, while recognizing the role and significance of competitiveness in the rapid technologically changing global environment, we agree that people-centred and public-good driven science, technology and innovation, supporting equitable growth and sustainable development, shall form the basis of our cooperation within the framework of BRICS.

4. In order to support this common vision, we agreed to enter into a BRICS Memorandum of Understanding on Cooperation in Science, Technology and Innovation which shall serve as the strategic intergovernmental framework: (i) to strengthen cooperation in science, technology and innovation; (ii) to address common global and regional socio-economic challenges utilizing shared experiences and complementarities; (iii) to co-generate new knowledge and innovative products, services and processes utilizing appropriate funding and investment instruments; (iv) to promote, where appropriate, joint BRICS partnerships with other strategic actors in the developing world.

5. We agree with the text of the BRICS Memorandum of Understanding on Cooperation in Science, Technology and Innovation and propose that it be signed on the occasion of the Sixth BRICS Summit in Brazil in 2014.

6. We agree under this BRICS STI framework the main areas of cooperation shall include: exchange of information on policies and programmes and promotion of innovation and technology transfer; food security and sustainable agriculture; climate change and natural disaster preparedness and mitigation; new and renewable energy, energy efficiency; nanotechnology; high performance computing; basic research; space research and exploration, aeronautics, astronomy and earth observation; medicine and biotechnology; biomedicine and life sciences (biomedical

---

engineering, bioinformatics, biomaterials); water resources and pollution treatment; high tech zones/science parks and incubators; technology transfer; science popularization; information and communication technology; clean coal technologies; natural gas and non-conventional gases; ocean and polar sciences; and geospatial technologies and its applications

7. In pursuit of cooperation in the above areas, we agree to build upon existing bilateral synergies and other forms of multi-country frameworks of cooperation amongst the BRICS member countries.

8. With a view to supporting the immediate implementation of the objectives outlined in the BRICS Memorandum of Understanding on Cooperation in Science, Technology and Innovation, we recognize and endorse, as a first step, the establishment of five thematic areas and leadership, namely: (a) climate change and natural disaster mitigation, led by Brazil;(b) water resources and pollution treatment, led by Russia; (c) geospatial technology and its applications, led by India; (d) new and renewal energy, and energy efficiency, led by China; (e) astronomy, led by South Africa.

9. We recognize the sharing and exchange of information on science, technology and innovation policies and strategies and the formulation of joint long-term problem-focused cooperation programmes will constitute the central modalities of this cooperation.

10. We recognize that specific cooperative activities under the BRICS STI framework may necessitate the provision of organizational, legal, financial and staffing support. This relates primarily to stimulating joint investment in the development of high technologies, creating common technology platforms, and the setting up of applied research and innovation centres and laboratories.

11. We recognize the importance and centrality of knowledge and technology transfer as the means of mutually empowering BRICS member countries. In this

---

regard we support efforts to establish BRICS mechanisms that enhance technology and knowledge transfer amongst the member countries.

12. We support the establishment of a dedicated BRICS STI training programme to address human capital challenges in BRICS member countries.

13. We commit to strengthen and improve the governance mechanisms for BRICS STI cooperation, including meetings of STI Ministers, senior officials meetings, as well as the network of national coordinators for cooperation in the spheres of science, technology and innovation.

14. Brazil, Russia, India and China extend warm appreciation and sincere gratitude to the Department of Science and Technology of the Republic of South Africa for hosting the First BRICS Science, Technology and Innovation Ministerial Meeting in Cape Town on 10 February 2014.

15. Russia, India, China and South Africa wish the Brazilian government well in its preparations for the Sixth BRICS Summit where deliberations relating to science, technology and innovation will form part of the agenda.

Done in the English language in five copies, each copy being equally authentic, on 10 February 2014 in Cape Town, South Africa.

---

## **II BRICS Science, Technology and Innovation Ministerial Meeting**



### **Brasília Declaration**

**Brasília, Brazil, 18 March 2015**

1. In line with the Fortaleza Declaration and the Action Plan adopted at the 6th BRICS Summit, on 15 July, 2014 held in Brazil, we, the Ministers for Science, Technology and Innovation 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, met in Brasília, Brazil, on 18 March, 2015, for the 2<sup>nd</sup> BRICS Science, Technology and Innovation Ministerial Meeting.

2. Recalling the theme of the 6<sup>th</sup> BRICS Summit "Inclusive Growth: Sustainable Solutions", we strongly believe that Science, Technology and Innovation play a central role in promoting inclusive macroeconomics and social policies and in the imperative to address challenges to humankind posed by the need to simultaneously achieve growth, inclusiveness, environmental protection and preservation.

3. We reaffirm that sharing and exchanging information on science, technology and innovation policies and strategies; leveraging contacts and programmes aimed at enhancing collaborative innovation projects among BRICS countries; and the formulation of joint long-term problem-focused cooperation programmes shall

---

constitute the central modalities of this cooperation. In order to facilitate this, appropriate mechanisms of cooperation shall be elaborated and established within the implementation of the BRICS Science, Technology and Innovation initiatives.

4. We welcome the outcomes of the 1<sup>st</sup> BRICS Workshop on Prevention and Mitigation of Natural Disasters, held in Brasília, on 7-8 May 2014; of the BRICS Seminar on National Systems of Innovation, held in Brasília, on 25-27 March 2014; of the Meeting of BRICS Solid State Lighting Working Group, held in Guangzhou, China, on 7-9 November 2014; and of the International Conference on Water Management and Ecology in the Framework of Russian Federation participation in BRICS, held in Moscow, Russia, on 4 June 2014.

5. Following the instructions of the leaders of BRICS member countries, mentioned in paragraph 67 of the Fortaleza Declaration, we express our satisfaction in signing the Memorandum of Understanding on Cooperation in Science, Technology and Innovation (MoU), which establishes a strategic framework for cooperation in priority areas amongst the BRICS member countries.

6. In order to foster further collaboration and achieve concrete results from the MoU directives, we agree to develop and negotiate a Work Plan 2015-2018, based on the Brazilian proposal, during the Russian presidency of BRICS, to be approved in the next BRICS STI-SOM and signed at the next BRICS STI Ministerial Meeting. The Work Plan will focus on the five priority areas and leadership established previously by each country, namely: (a) prevention and mitigation of natural disasters, to be led by Brazil, (b) water resources and pollution treatment, to be led by Russia, (c) geospatial technology and its applications, to be led by India, (d) new and renewable energy, and energy efficiency, to be led by China, and (e) astronomy, to be led by South Africa. New initiatives agreed by the BRICS countries will also be included in the Work Plan.

---

7. We take note of the following announcements: South Africa will convene the 1st Meeting of the BRICS Working Group on Astronomy shortly after this Ministerial; Russia will host International Scientific and Experimental Conference on Water: Technologies, Materials in Industry and Energy Processes in July 2015, in Ufa; China will host the 2nd Meeting of the BRICS SSL Working Group in November 2015; India will host the BRICS Working Group on Geospatial Technology Application for Development in March 2016. We also welcome the Brazilian- Russian proposal, discussed on the occasion of the 4<sup>th</sup> STI-SOM, to start negotiations among BRICS countries with a view to establishing biomedicine and life sciences as a new priority area for cooperation.

8. The Work Plan will ensure the development of science, technology and innovation cooperation through the launch of a BRICS Research and Innovation Initiative, which shall cover actions including: (a) cooperation in the framework of major research infrastructures; (b) coordination of existing large-scale national programmes of BRICS countries; (c) setting up a Framework Programme for funding multilateral joint project for research, technology commercialization and innovation; and (d) establishment of a joint Research and Innovation Networking Platform.

9. We support the creation of a BRICS Young Scientists Forum proposed by India, which intends to establish a platform for young students of science, engineering and applied disciplines as well as for those pursuing research careers in the age group of 22-35 years to gather for: (a) addressing the needs for advancement of skills, research competencies, career, talent and next generation scientific leadership; (b) sharing scientific research results and experiences; (c) discussing novel ideas in emerging frontline fields of S&T; (d) analyzing trends and features of globally important scientific issues; (e) suggesting measures to enhance trans-continental mobility in their scientific research careers.



---

10. To increase the competitiveness of the BRICS economies on the global arena, we commit to supporting the BRICS Economic Partnership Strategy, currently under negotiation, which includes Science, Technology and Innovation as a priority. Long-term cooperation in these areas will help bridge the scientific and technological gap between BRICS and developed economies and provide a new quality of growth based on economic complementarity.

11. We encourage increased participation of business, academia and other relevant stakeholders for science, technology and innovation development among BRICS countries.

12. We welcome the holding of the 4<sup>th</sup> BRICS Science, Technology and Innovation Senior Officials Meeting in Brasília, on 17 March 2015, and instruct the Senior Officials to organize the 5th BRICS STI-SOM prior to the 3<sup>rd</sup> Ministerial Meeting.

13. Russia, India, China and South Africa extend their warm appreciation to Brazil for hosting the 2<sup>nd</sup> BRICS Science, Technology and Innovation Ministerial Meeting and the 4<sup>th</sup> BRICS Science, Technology and Innovation Senior Officials Meeting.

14. Brazil, India, China and South Africa convey their appreciation to the Russian Federation for its offer to host the 3rd BRICS Science, Technology and Innovation Ministerial Meeting and the 5th BRICS Science, Technology and Innovation Senior Officials Meeting in 2015 and extend their full support to that end.

---

**III BRICS Science, Technology and Innovation Ministerial Meeting**  
**Theme: BRICS Science, Technology and Innovation Partnership – a Driver of**  
**Global Development**



**Moscow Declaration**

**Moscow, the Russian Federation, 28 October 2015**

1. In line with the Ufa Declaration and Action Plan adopted at the Seventh BRICS Summit on 9 July 2015 held in Russia we, the Ministers and their representatives for Science, Technology and Innovation 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, met in Moscow, the Russian Federation, on the 28<sup>th</sup> of October 2015, for the III BRICS Science, Technology and Innovation Ministerial Meeting to build further collaboration based on the Memorandum of Understanding on Cooperation in Science, Technology and Innovation (MoU) provisions.
2. Recalling the theme of the Seventh BRICS Summit "BRICS Partnership -a Powerful factor of Global Development", we affirm our willingness to follow the Strategy for BRICS Economic Partnership in addressing common global and regional socio-economic challenges utilizing such drivers as science, technology and innovation (STI).
3. Welcoming the outcomes of the First Meeting of the BRICS STI Funding Parties on the establishment of the BRICS Research and Innovation Initiative (hereinafter -BRICS R&I Initiative) held on 6-7 July 2015, Moscow, Russia, and highlighting the immense research and technological potential in the BRICS member countries and importance of the development of BRICS R&I Initiative (paragraph 62 of the Ufa Declaration) we agree on the following mechanisms and levels of collaboration: (i) cooperation within large

---

research infrastructures, including mega-science projects; (ii) coordination of the existing large-scale national programmes of the BRICS countries; (iii) development and implementation of a BRICS Framework Programme for funding multilateral joint research projects, technology commercialization and innovation; (iv) establishment of BRICS Research and Innovation Networking Platform.

4. We welcome the establishment of the Working Group on BRICS large research infrastructures, the Working Group on BRICS funding multilateral joint research projects, technology commercialization and innovation.

5. We agree on our commitment to develop and implement the BRICS Framework Programme on multilateral research funding through joint calls. Also we propose to use the possibilities of the New Development Bank (Agreement of the New Development Bank signed during the VI BRICS Summit in Fortaleza) as an additional funding instrument to foster further collaboration.

6. The cooperation focused on the five thematic leadership areas established previously by each country in the Brasilia Declaration, namely: (a) prevention and mitigation of natural disasters, led by Brazil, (b) water resources and pollution treatment, led by Russia, (c) geospatial technology and its applications, led by India, (d) new and renewable energy, and energy efficiency, led by China, and (e) astronomy, led by South Africa, and the activities within these five areas will be implemented by use of the BRICS Research and Innovation Networking Platform developing direct communication channel between stakeholders.

7. To address common societal challenges and to advance BRICS leadership and cooperation on a global level we welcome the new initiatives:

- Creation of BRICS Young Scientists Forum (India as coordinating country);
- Cooperation on Biotechnology and Biomedicine including Human Health and Neuroscience (Russia and Brazil as coordinating countries);
- Cooperation on Information Technologies and High Performance Computing (China

---

and South Africa as coordinating countries);

- Cooperation on Ocean and Polar Science and Technology (Brazil and Russia as coordinating countries);
- Cooperation on Material science including Nanotechnology (India and Russia as coordinating countries);
- Cooperation on Photonics (India and Russia as coordinating countries).

8. Encouraging increased participation of business, academia and other relevant stakeholders for STI development among BRICS countries (paragraph 11, Brasilia Declaration) we acknowledge the independent initiatives to establish the BRICS Network University aimed at developing master's and PhD programmes along with joint research projects in knowledge fields priorities corresponding with the main areas of cooperation stated in the Article 3 of the MoU and the BRICS University League.

9. We welcome the creation of a BRICS Young Scientists Forum and establishing the BRICS Young Scientist Forum Secretariat in India coordinated by the Department of Science and Technology with commitment and support from all BRICS countries. We also welcome hosting of the BRICS Young Scientist Conclave in 2016 in India and creation of dedicated website for BRICS Young Scientist Forum.

10. We also support creation of BRICS Research and Innovation Networking Platform.

11. We take note of the following announcements: India and Brazil host the BRICS thematic Session on Prevention and Mitigation of Natural Disasters during the 6th Annual Conference of the International Society for Integrated Disaster Risk Management in October 2015; China hosts the 2nd Meeting of the BRICS Solid-state lightning (SSL) Working Group in November 2015; South Africa hosts the first meeting of the BRICS Astronomy Working Group in December 2015 at the Science Forum South Africa; India hosts the BRICS Working Group on Geospatial Technology Application for Development in March 2016; Russia initiates 2nd Meeting of the Group of STI Funding Parties in January 2016.

---

12. We endorse the BRICS Science, Technology and Innovation Work Plan 2015-2018 and reaffirm our commitment to implement it (annexed).

13. Brazil, India, China and South Africa convey their appreciation to the Russian Federation for hosting the III BRICS STI Ministerial meeting in Moscow.

14. Russia, Brazil, China and South Africa convey their appreciation to India for its offer to host the IV BRICS STI Ministerial meeting and the VI BRICS STI SOM in 2016 and extend their full support to that end.

---

## IV BRICS Science, Technology and Innovation Ministerial Meeting

### Theme: BRICS Science, Technology and Innovation Partnership – Building Responsive Inclusive Collective Solutions



#### Jaipur Declaration

**Jaipur, the Republic of India, 8 October 2016**

1. Preparatory to and in line with the proposed Goa Declaration and Action Plan to be adopted at the Eighth BRICS Summit on 15-16 October 2016 in Goa, India, we, the Ministers and their representatives for Science, Technology and Innovation 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, met in Jaipur, the Republic of India, on the 8<sup>th</sup> of October 2016, for the 4<sup>th</sup> BRICS Science, Technology and Innovation Ministerial Meeting to build further collaboration based on the BRICS Memorandum of Understanding on Cooperation in Science, Technology and Innovation (MoU) .
2. Taking into consideration the theme of the Eighth BRICS Summit – **Building Responsive Inclusive Collective Solutions**; we reaffirm our commitment to implement the Strategy for BRICS Economic Partnership adopted at the BRICS Ufa Summit which emphasized utilizing Science, Technology and Innovation (STI) as key drivers to address global and regional socio-economic challenges.
3. Welcoming the collective achievements of BRICS partners in the realization of initiatives established in accordance with the BRICS Science, Technology and Innovation Work Plan 2015-2018 (Work Plan 2015-2018) and Moscow Declaration adopted on 28 October 2015, we reaffirm our commitment to implement the Work Plan 2015-2018. We will intensify, diversify

---

and institutionalize STI cooperation as outlined in the BRICS MoU on Cooperation in Science, Technology and Innovation through the mechanism of the BRICS Research and Innovation Initiative.

4. Welcoming the outcomes of the Second Meeting of the BRICS STI Funding Parties on the Development of the BRICS Research and Innovation Initiative and First Meeting of BRICS STI Funding Working Group held in Beijing on 19-21 January 2016, we welcome the signing of the Arrangement of the BRICS STI Framework Program and the Implementation Plan (hereinafter—BRICS Arrangements). These Arrangements will be instrumental in implementation of BRICS countries' joint initiative on multilateral interdisciplinary research & innovation funding under the BRICS STI Framework Program as evident from the launching of the 1<sup>st</sup> BRICS Pilot Call 2016 in mutually agreed priority areas. We take note of the huge response of BRICS scientists to work together in the BRICS multilateral research projects.

5. We take note of the conclusions of the First Photonics Conference of BRICS countries held on May 30-31, 2016, Moscow. We welcome the establishment of a BRICS Working Group on Photonics.

6. We welcome the establishment of BRICS Geospatial Working Group and its 1<sup>st</sup> Meeting held in India on 3 March 2016.

7. We welcome the hosting of 1<sup>st</sup> BRICS Young Scientist Conclave by India during 26-30 September, 2016, under the framework of the BRICS Young Scientist Forum being coordinated by India, as mandated by BRICS Leaders during 7<sup>th</sup> BRICS Summit. We take note of the recommendations of the BRICS Young Scientists Conclave.

8. We welcome India's proposal to host the BRICS Young Scientist Forum-Conclave on a rotation basis in the BRICS Chair country to keep the momentum for engaging youth of BRICS countries and explore mechanisms for implementation.

---

9. We welcome India's proposal to establish the **BRICS Innovative Idea Prize for Young Scientists** within the framework of the BRICS Young Scientist Forum.

10. We welcome the establishment of the BRICS Working Group on Astronomy and its meetings held in South Africa and Russia.

11. We take note of the outcomes of the BRICS thematic session on Prevention and Mitigation of Natural Disasters outlined during 6th Annual Conference of the International Society for Integrated Disaster Risk Management hosted by India in October 2015 in New Delhi; and of the BRICS Special Session on Natural disaster risk prevention and Mitigation in Coastal Areas jointly organized by Russia and Brazil in Saint Petersburg on 26 August, 2016

12. We take note of the 1<sup>st</sup> Meeting of the BRICS Working Group on Ocean and Polar Science and Technology held in Beijing on 26-28 September 2016 coordinated by Brazil.

13. We take note of the 2<sup>nd</sup> BRICS Water Forum hosted by Russia during 29-30 September 2016.

14. We take note of the 2<sup>nd</sup> Meeting of BRICS Working Group on Solid State Lighting hosted by China in November, 2015.

15. We agree to launch next the BRICS Framework Program call for research and innovation proposals in May 2017.

16. We agree on the speedy establishment of the BRICS Working Group on Research Infrastructure, and Mega-Science to reinforce the BRICS Global Research Advanced Infrastructure Network (BRICS-GRAIN). We recommend exploring the possibility of supporting such initiatives through New Development Bank as well as other similar organizations.



---

17. We encourage synergies of the BRICS Research and Innovation Initiative with the BRICS Network University.

18. We welcome India's proposal to establish a BRICS Science and Technology driven Entrepreneurship and Innovation Partnership. We agree to start consultations and discussions to implement this initiative.

19. Pursuant to the BRICS Work Plan 2015-2018, we take note on the progress made during 2015-2016 and endorse the Action Plan 2016-2017 as updated.

20. Brazil, Russia, China and South Africa convey their appreciation to India for hosting the 4<sup>th</sup> BRICS STI Ministerial Meeting and 6<sup>th</sup> BRICS STI SOM in Jaipur.

21. India, Brazil, Russia and South Africa welcome the offer of China to host the 5<sup>th</sup> BRICS STI Ministerial Meeting and the 7<sup>th</sup> BRICS STI SOM in 2017.

Done at Jaipur on October 8, 2016

---

## **V BRICS Science, Technology and Innovation Ministerial Meeting**

**Theme: Leading through Innovation & Deepening Cooperation**



### **The 5<sup>th</sup> BRICS Science, Technology & Innovation (STI) Ministerial Meeting**

#### **Hangzhou Declaration**

**Hangzhou, China, 18 July 2017**

1. In line with the *BRICS Memorandum of Understanding on Cooperation in Science, Technology and Innovation* signed in March 2015 and the *Goa Declaration* adopted at the BRICS Summit held in India on October 16, 2016, we, the Ministers for Science, Technology and Innovation 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 met in Hangzhou, China, on 18 July, 2017, for the 5<sup>th</sup> BRICS Science, Technology & Innovation (STI) Ministerial Meeting.

2. Recalling the theme of the BRICS XIAMEN SUMMIT “BRICS: Stronger Partnership for a Brighter Future”, we will continue to strengthen pragmatic cooperation in science, technology and innovation (STI) among the BRICS countries, create new cooperation opportunities, expand partnerships, and jointly tackle global challenges.

3. Based on the theme of the 5<sup>th</sup> BRICS Science, Technology & Innovation Ministerial Meeting “Leading through Innovation & Deepening Cooperation”, we reaffirm the importance of innovation dialogues leading to outcomes and STI

---

cooperation for promoting innovation-driven development and supporting the robust and sustainable growth of the world economy. We will continue to strengthen STI cooperation and implement relevant BRICS research and innovation initiatives mainly by means of exchanges in innovation policies and strategies and drafting of long-term cooperation plans to address common developmental challenges faced by all BRICS countries.

4. In order to promote innovation and leverage the central role of science and technology in enhancing socio-economic development and driving global sustainable development, we agree to adopt the *BRICS Action Plan for Innovation Cooperation*. We agree to promote entrepreneurship and build platforms in BRICS countries and mainly collaborate in technology cooperation, technology transfer and translation, science and technology parks, youth innovation and entrepreneurship and in fostering strategic and long term university-industry partnerships so as to build sound ecosystems for innovation and entrepreneurship.

5. Building on the positive experience and spin-off of the 1<sup>st</sup> BRICS Young Scientist Conclave under the framework of the BRICS Young Scientist Forum held in India last year, we welcome the convening of the 2<sup>nd</sup> BRICS Young Scientist Forum in Hangzhou, China. We recognize the potential of the Young Scientist Forum to develop into a powerful networking platform for BRICS young scientists and entrepreneurs and become an important arena to stimulate new academic ideas and train young professionals for the BRICS. We therefore fully support South Africa's decision to host the 3<sup>rd</sup> Young Scientist Forum in the lead up to the 6<sup>th</sup> BRICS STI Ministerial Meeting in South Africa in 2018. We encourage representatives of the BRICS thematic working groups to support participation of youth and invite themes for BRICS Young Scientist Forum.

6. We welcome the approval of the first set of BRICS R&D projects in priority areas. We recognize the importance of the BRICS STI Framework Programme as a mechanism for pooling innovation resources and strengths, and driving development in major areas and key technologies. We welcome the decision to launch the 2<sup>nd</sup> BRICS STI Call 2017 in six priority areas with Russia continuing as the Call

---

Secretariat. We support the restated commitment of BRICS Science and Technology Ministries and their relevant funding agencies to continue jointly funding such multilateral R&D projects.

7. Acknowledging the importance of supporting cutting-edge high-impact research, we will encourage researchers from BRICS countries to publish the results of their research in international high-impact journals and participate as external foreign reviewers in the review of research proposals submitted to the funders in other BRICS countries, ensuring the quality of scientific review system within BRICS.

8. Recognizing the need for setting concerted priorities for S&T cooperation, we promote to support joint activities on identified priorities for S&T cooperation of BRICS countries based on foresight and monitoring of global S&T development.

9. We welcome India's initiative to coordinate the 1<sup>st</sup> meeting of BRICS Science and Technology Driven Entrepreneurship and Innovation Partnership in April 9<sup>th</sup>, 2017; and endorse the Term of Reference of the BRICS Working Group on Science Technology, Innovation and Entrepreneurship Partnership (STIEP).

10. We welcome China hosting the 1<sup>st</sup> Working Group Meeting and Innovation Collaboration Forum on Information and Communication Technology and High Performance Computing in April, 2017 which presented several cooperation proposals including working together in relevant flagship projects.

11. We welcome Russia hosting the 1<sup>st</sup> Meeting of the BRICS Working Group on Research Infrastructure and Mega-Science Projects to strengthen cooperation on the BRICS Global Research Advanced Infrastructure Network and mega-science projects.

12. We welcome the convening of the 3<sup>rd</sup> BRICS STI Funding Working Group Meeting in South Africa in May, 2017 for discussion and negotiation on the approval of the first set of projects to be funded and the second call for proposals, and the

---

outcomes of various thematic working group meetings or workshops.

13. Based on the BRICS STI Work Plan 2015-2018, we recognize the progress of BRICS STI cooperation since 2015 and adopt the updated BRICS STI Action Plan 2017-2018 .

14. Acknowledging the importance of supporting STI investment and the need to establish inter-BRICS investment instruments, we support explore the possibilities of driving BRICS cooperation on innovation and entrepreneurship through the National Development Banks, New Development Bank and other existing financing platforms.

15. Brazil, Russia, India and South Africa extend their warm appreciation to the Ministry of Science and Technology of China for hosting the 5<sup>th</sup> BRICS STI Ministerial Meeting and the 7<sup>th</sup> BRICS STI Senior Officials Meeting.

16. Brazil, Russia, India, and China convey their appreciation to South Africa for its offer to host the 6<sup>th</sup> BRICS STI Ministerial Meeting and the 8<sup>th</sup> BRICS STI Senior Officials Meeting and extend their full support to that end.

---

**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**

**PREAMBLE**

The Government of the Federative Republic of Brazil, The Government of the Russian Federation, The Government of the Republic of India, The Government of the People’s Republic of China, and The Government of the Republic of South Africa (hereinafter referred to as the "Parties");

**REAFFIRMING** the overarching vision embodied in the BRICS Summit Declarations, including the 2011 BRICS Sanya Declaration which identified the need “to explore cooperation in the sphere of science, technology and innovation, including the peaceful use of space”;

---

**NOTING** the recommendations of the First, Second and Third BRICS Science, Technology and Innovation Senior Officials Meetings, held respectively in Dalian, China, in September 2011 Pretoria, South Africa, in November 2012, and New Delhi, India in December 2013;

**HARNESSING** potential bilateral synergies and other forms of multi-country frameworks of cooperation amongst Brazil, Russia, India, China and South Africa in science, technology and innovation;

**DESIROUS** to further strengthen cooperation in the fields of science, technology and innovation for accelerated and sustainable socio-economic development amongst the five countries;

**RECOGNIZING** the importance of cooperation based on the principles of voluntary participation, equality, mutual benefit, reciprocity and subject to the availability of earmarked resources for collaboration by each country;

**RECOGNIZING** the variable geometry of the research and development systems of the BRICS member countries;

**HEREBY AGREE** as follows:

## **ARTICLE 1**

### **Competent Authorities**

The competent authorities responsible for the implementation of this Memorandum of Understanding will be the following designated organisations:

- (a) For the Federative Republic of Brazil, the Ministry of Science, Technology and Innovation (MCTI);
- (b) For the Russian Federation, the Ministry of Education and Science (MES);

- 
- (c) For the Republic of India, the Department of Science and Technology (DST, India);
  - (d) For the People's Republic of China, the Ministry of Science and Technology (MOST);
  - (e) For the Republic of South Africa, the Department of Science and Technology (DST, South Africa).

## **ARTICLE 2**

### **Objectives**

The main objectives of this Memorandum of Understanding are:

- (a) To establish a strategic framework for cooperation in science, technology and innovation amongst the BRICS member countries;
- (b) To address common global and regional socio-economic challenges in the BRICS member countries utilising shared experiences and complementarities in science, technology and innovation;
- (c) To co-generate new knowledge and innovative products, services and processes in the BRICS member countries utilising appropriate funding and investment instruments;
- (d) To promote, where appropriate, joint BRICS science, technology and innovation partnerships with other strategic actors in the developing world.

## **ARTICLE 3**

### **Areas of Cooperation**



---

The main areas of cooperation under this Memorandum of Understanding shall include but not be confined to:

- (a) Exchange of information on policies and programmes and promotion of innovation and technology transfer;
- (b) Food security and sustainable agriculture;
- (c) Natural disasters;
- (d) New and renewable energy, energy efficiency;
- (e) Nanotechnology;
- (f) High performance computing;
- (g) Basic research;
- (h) Space research and exploration, aeronautics, astronomy and earth observation;
- (i) Medicine and biotechnology;
- (j) Biomedicine and life sciences (biomedical engineering, bioinformatics, biomaterials);
- (k) Water resources and pollution treatment;
- (l) High tech zones/science parks and incubators;
- (m) Technology transfer;
- (n) Science popularization;
- (o) Information and communication technology;
- (p) Clean coal technologies;
- (q) Natural gas and non-conventional gases;
- (r) Ocean and polar sciences;
- (s) Geospatial technologies and its applications.

---

## **ARTICLE 4**

### **Mechanisms and Modalities of Cooperation**

The principal mechanism for cooperation shall be this Memorandum of Understanding. The Parties or their designated institutions may enter into sub-agreements which shall be governed by the terms of this Memorandum of Understanding.

The modalities of cooperation under this Memorandum of Understanding and sub-agreements arising there-from between the Parties in the fields of science, technology and innovation shall take the following forms:

- (a) Short-term exchange of scientists, researchers, technical experts and scholars;
- (b) Dedicated training programmes to support human capital development in science, technology and innovation;
- (c) Organization of science, technology and innovation workshops, seminars and conferences in areas of mutual interest;
- (d) Exchange of science, technology and innovation information;
- (e) Formulation and implementation of collaborative research and development programmes and projects;
- (f) Establishment of joint funding mechanisms to support BRICS research programmes and large-scale research infrastructure projects;
- (g) Facilitated access to science and technology infrastructure among BRICS member countries;
- (h) Announcement of simultaneous calls for proposals in BRICS member countries;

- 
- (i) Cooperation of national science and engineering academies and research agencies.

## **ARTICLE 5**

### **Governing Structures**

The main structures governing cooperation under this Memorandum of Understanding shall include:

- 1. BRICS Science, Technology and Innovation Ministerial Meeting**
- 2. BRICS Science, Technology and Innovation Senior Officials Meeting**
- 3. BRICS Science, Technology and Innovation Working Group**

1. The BRICS Science, Technology and Innovation Ministerial Meeting (comprising Ministers responsible for science, technology and innovation in Brazil, Russia, India, China and South Africa) shall convene at least once every year during the presidency of a member country. The main responsibilities of the BRICS Science, Technology and Innovation Ministerial Meeting will include:

- (a) Providing an overarching vision and advice on institutional and financial frameworks for major BRICS science, technology and innovation programmes and initiatives;
- (b) Facilitating linkages between the BRICS science, technology and innovation working group and other BRICS sectoral working groups or BRICS expert groups to ensure the effective implementation and realisation of the objectives of this Memorandum of Understanding;
- (c) Setting priorities for cooperation and joint action in science, technology and innovation amongst BRICS member countries for a given period of time, taking into account the priority areas indicated in Article (3) above.

---

2. The BRICS Science, Technology and Innovation Senior Officials' Meeting will constitute Directors-General (or equivalent) of BRICS member countries as the leaders of delegation, BRICS science, technology and innovation country coordinators, focal points, scientists, experts and other relevant officials.

The BRICS Science, Technology and Innovation Senior Officials' Meeting will meet annually in the country where the BRICS Summit is hosted.

Responsibilities of the BRICS Science, Technology and Innovation Senior Officials' Meeting will include:

- (a) Exchanging information on recent science, technology and innovation developments as well as identifying common policy challenges in BRICS member countries;
- (b) Supporting the implementation of strategic decisions related to science, technology and innovation taken by the BRICS Summits, as well the high-level decisions emanating from BRICS Science, Technology and Innovation Ministerial Meetings;
- (c) Facilitating BRICS science, technology and innovation cooperation mainly through the prioritisation of the thematic areas identified in Article (3) of this Memorandum of Understanding;
- (d) Configuring appropriate funding mechanisms and instruments to support BRICS science, technology and innovation cooperation;
- (e) Harnessing synergies in respect of science, technology and innovation priority directions at bilateral, multilateral and poly-lateral levels within BRICS;
- (f) Approving 3-5 year cycles for BRICS science, technology and innovation initiatives and programmes;
- (g) Reviewing periodically progress in terms of implementation with respect to science, technology and innovation cooperation under this Memorandum of Understanding, as well as identifying new areas, activities and cooperation modalities of mutual interest;

- 
- (h) Providing recommendations for consideration by the BRICS Science, Technology and Innovation Ministerial Meeting to enhance effective implementation of this Memorandum of Understanding;
  - (i) Considering other agenda matters deemed appropriate by the BRICS member countries.

3. The BRICS Science, Technology and Innovation Working Group will constitute the five BRICS science, technology and innovation country coordinators whose responsibilities will include:

- (a) Fulfilling the function of Secretariat for the BRICS Science, Technology and Innovation SOM (developing the agenda and annotations for the BRICS science, technology and innovation SOM; recording proceedings of the SOM etc.);
- (b) Convening Science, Technology and Innovation Working Group meetings between sessions of the Science, Technology and Innovation SOM.

## **ARTICLE 6**

### **Funding Mechanisms and Instruments**

Science, technology and innovation cooperation under this Memorandum of Understanding will be supported by appropriate BRICS country funding mechanisms, instruments and national rules.

The key objectives of the BRICS science, technology and innovation funding mechanisms and instruments shall be:

- (a) To establish R&D programmes in frontier and priority research areas in support of sustainable development in BRICS member countries;

- 
- (b) To promote the co-generation of new knowledge and innovative products, services and processes;
  - (c) To co-invest in large scale research infrastructure projects;
  - (d) To facilitate technology and knowledge transfer and implementation;
  - (e) To facilitate policy development in science, technology and innovation;
  - (f) To facilitate linkages with various forums dealing with business, academia, research and development centres, government agencies and institutions.

## **ARTICLE 7**

### **Management of Intellectual Property Rights**

1. The parties will ensure adequate and effective protection and fair allocation of intellectual property rights of a proprietary nature that may result from the cooperative activities under this Memorandum of Understanding, according to their respective national laws and regulations and their international obligations.
2. The condition for the acquisition, maintenance and commercial exploitation of intellectual property rights over possible products and/or processes that might be obtained under this Memorandum of Understanding will be defined in the specific programmes, contracts or working plans of the activities of cooperation.
3. The specific programmes, contracts or working plans relating to the activities of cooperation mentioned in Paragraph 2 of this Article will set out the conditions regarding the confidentiality of information whose publication and/or disclosure might jeopardize the acquisition, maintenance and commercial exploitation of intellectual property rights obtained under this Memorandum of Understanding. Such specific programmes, contracts or working plans related to the activities of cooperation will establish, where applicable, the rule and procedures concerning the settlement of disputes on intellectual property matters under this Memorandum of

---

Understanding.

## **ARTICLE 8**

### **Final Dispositions**

1. This Memorandum of Understanding will come into force on the date of signature and will remain valid for five (5) years. Thereafter, this Memorandum of Understanding shall be renewed automatically for successive equal periods, unless one of the Parties notifies the others in writing its intention to terminate this Memorandum of Understanding.
2. The present Memorandum of Understanding may be amended at any time, by mutual consent of the Parties, through diplomatic channels.
3. Any Party may, at any time, notify the others of its intention to terminate the present Memorandum of Understanding. Termination will be effective six (6) months after the date of the notification and will not affect the ongoing activities of cooperation, unless otherwise agreed by the Parties.
4. Any dispute related to the interpretation or implementation of the present Memorandum of Understanding will be settled by direct negotiations between the Parties, through diplomatic channels.

**IN WITNESS WHEREOF** the undersigned, being duly authorized thereto by their respective Governments, have signed this Memorandum of Understanding in five originals, in Portuguese, Russian, Hindi, Chinese and English languages, all texts being equally authentic. In case of any divergence of interpretation, the English text will prevail.

---

## **BRICS Action Plan for Innovation Cooperation**

### **(2017-2020)**

#### **I. Foreword**

We, BRICS countries,

1. With 42% of the world population, contribute 18% of global GDP, 17% of global R&D investment and 27% of science papers published on international journals, as an important force of international economic cooperation and one of the most dynamic and promising emerging economies, BRICS countries are major representatives of emerging economies in the world. Our collective efforts are to undertake innovation and cooperation and facilitate innovation-driven development for sustainable development of the world economy.

2. Reaffirm that innovation refers to the embodiment of an idea in a technology, product, or process that is new and creates productive value. An innovation is the implementation of a new or significantly improved product (good or service), or process which derives from creative ideas, technological progress, a new marketing method or a new organizational method in business practices, workplace organization or external relations. Innovation covers a wide range of domains with science, technology and innovation (STI) as the core.

3. We will actively promote cooperation in STI under bilateral and multilateral frameworks in accordance with the *MoU on Cooperation in STI between the Governments of BRICS Countries*, *Jaipur Declaration*, and the theme of the 5<sup>th</sup> BRICS STI Ministerial Meeting, thus drive rapid and sustainable economic growth and social progress in the BRICS countries.

4. Stress that innovation is one of the key driving forces of global sustainable development, playing a fundamental role in promoting economic growth, supporting job creation, entrepreneurship and structural reform, enhancing productivity and competitiveness, providing better services for the citizens and addressing global challenges. The BRICS



---

countries aim to encourage innovation through practical actions to promote sustainable economic growth today and lay a solid foundation for tomorrow.

## **II. Action Plan**

BRICS countries are facing new challenges in economic development though our economic prospects and growth momentum remain unchanged. In this context, we are committed to the following steps:

1. Promoting exchanges and good practices among the BRICS countries on innovation strategies and policies; enhancing mutual understanding, complementarity and coordination for the BRICS cooperation in innovation, and in particular, for the attainment of socio-economic progress driven by scientific, technological and social innovation, for the building of a BRICS community of shared values and common future, and for the realization of sustainable development goals.
2. Strengthening cooperation in scientific and research activities, enhancing cooperation in innovation based on existing mechanisms and joint research programmes including such cooperation conducted through public-private partnerships; fostering strategic and long term university-industry partnerships to address the needs of industry and contributing directly to economic growth and development; continuing to encourage and support research and development projects in the areas of fundamental and applied research and innovation within bilateral and multilateral frameworks and continuing to carry out joint calls for STI projects; understanding the importance of implementing BRICS initiatives related to research and innovation; promoting open science and the sharing of research infrastructure; developing and initiating international mega science programmes.
3. Organizing joint activities on identifying priorities for STI cooperation of BRICS countries based on foresight and monitoring of global STI development.
4. In view of the importance of science and technology parks for regional economic development, encouraging cooperation among science parks including supporting the transnational establishment of BRICS hi-tech enterprises in S&T parks. We welcome the

---

establishment of exchange mechanisms for science parks, and expanding areas of cooperation in these domains.

5. Encouraging technology transfer among the BRICS countries, strengthening training of technology transfer professionals, developing platforms for collaboration among businesses and academia, enabling extensive and orderly transfer and translation of innovation achievements in the BRICS countries. Utilizing existing technological network platforms as instruments of search for foreign partners for technological collaboration and initiation of joint STI projects.

6. Promoting BRICS Partnerships on Youth Innovation and Entrepreneurship to carry out pragmatic cooperation, advocating the entrepreneurial spirit of encouraging innovation and tolerating failure, and to create a favorable ecosystem for innovation and entrepreneurship amongst the younger generation.

7. Acknowledging the importance of supporting STI investment and the need to establish inter-BRICS investment instruments, we support explore the possibilities of driving BRICS cooperation on innovation and entrepreneurship through the National Development Banks, New Development Bank and other existing financing institutions.

8. Supporting the mobility of STI human resources, especially exchanges among young scientists and entrepreneurs, supporting efforts to help address the future demand for new skills, sharing best practices on enhancing skills training for innovation and entrepreneurship, including improving access to Science, Technology, Engineering and Mathematics (STEM) education, creating jobs through joint research and collaboration in innovation and entrepreneurship, and stressing the role of youth in innovation. Stressing the role of women in science, technology and innovation activities as one of the key priorities of the BRICS STI Agenda.

### **III. Implementation**

The BRICS Science Technology Innovation and Entrepreneurship Partnership (STIEP) Working Group will be responsible for the development of mechanisms and opportunities to

---

implement the Action Plan, which will in the first period focus on the following deliverables:

1. Creation of networks of science parks, technology business incubators and SMEs, where the innovation actually happens.
2. Creation of cross-cultural talent pools for converting ideas into solution in domains of ICT, materials, water, health, energy, natural disaster risk reduction and resilience etc.

18 July 2017, Hangzhou

---

## POSTSCRIPT

Science and technology is the cornerstone of a prosperous country, innovation is the spirit of a nation in its progress. Historical experience shows that those who can gain advantage in science, technology and innovation (STI) will gain the initiative of development. At present, the world economy is going through a treacherous recovery amidst deep adjustment and a new round of global technological and industrial revolutions is gaining momentum. In this world of dynamic and intensive innovation and in this age of new competition, all countries are making vigorous effort to promote innovation and seize opportunities. National innovative competitiveness which is underpinned by STI has become a focus of attention for all countries. Emerging economies represented by BRICS countries are taking up an increasingly important role in the global arena. In particular, in the wake of the global financial crisis in 2008, BRICS countries have attracted much world attention with its speedy recovery and development, making a sharp contrast to the troubling situation in developed economies. The prospect of sustained development in BRICS countries is very much determined by their comprehensive innovation capability with STI at its core.

In 2017, China takes over the BRICS presidency, and will host the ninth BRICS Summit in Xiamen, Fujian province in September. The Chinese Ministry of Science and Technology is responsible for organizing the fifth BRICS STI Ministerial Meeting and Senior Officials Meeting, and other related side events in July in Hangzhou. The China Science and Technology Exchange Center (CSTEC), which is the Chinese liaison office for BRICS STI cooperation, will support the organization of the ministerial meeting, the senior officials meeting and other side events.

To support the work relating to BRICS STI cooperation under the Chinese presidency in 2017, CSTEC, as entrusted by the Ministry of Science and Technology, established a High-level Expert Group consisting of leading professionals from the Central Party School, the Chinese Academy of Sciences, Tsinghua University, Renmin University, Fujian Normal University and other organizations to research the comprehensive innovative competitiveness of BRICS countries based on the latest statistics, analyzed the status quo, problems and potential of BRICS STI cooperation, and conducted country and thematic studies on BRICS countries' performance in STI. Under the guidance of the High-level Expert Group and with the participation

---

of science and technology sections of Chinese embassies in other BRICS countries as well as the Russian Higher School of Economics and other BRICS think tanks for research on STI, we have compiled the *BRICS Innovative Competitiveness Report 2017* (Chinese and English editions) based on the results of initial research in order to provide input for the decisions at the BRICS STI Ministerial Meeting and the drafting of other related documents.

This report contains four parts, with a total of 12 reports.

The first part has two reports. The first is the analysis report on the overall evaluation and forecast of innovative competitiveness of BRICS countries and the current status and strategic priority of BRICS STI cooperation; the second is the research report on the priority areas of BRICS STI cooperation based on the win-win strategy. The two reports have evaluated the comprehensive innovative competitiveness of the BRICS countries since 2001 and predicted the innovative competitiveness of the five countries in the future. They have also assessed the current state and effect of China's STI cooperation with other BRICS countries, and analyzed the priority areas of BRICS STI cooperation, providing a valuable reference for BRICS countries to make key decisions on accelerating the building of national innovative competitiveness. This part of the report is drafted by Zhao Xinli, Wang Dan, Xiao Yi, Dong Quanchao, Huo Hongwei, Ma Zongwen, Xin Bingqing and Russian experts Alexander Sokolov, Sergey Shashnov, Maxim Kotsemir and Anna Grebenyuk

The second part is country reports, which evaluates and analyzes the innovative competitiveness of individual BRICS countries and studies STI cooperation within the BRICS framework. Each country report starts with an analysis on its cooperation with China and within the BRICS framework, presents the features, strategies and differences of the innovative competitiveness of respective BRICS countries, and highlights the competitiveness advantage and weaknesses of each country. The science and technology sections of Chinese embassies in BRICS countries are also involved in the drafting of this part, providing the most up-to-date and authoritative information included in the country reports. The Brazil part is drafted by Wang Lei, Gao Changlin, Dong Quanchao and Shi Tao; the Russian section includes one report drafted by Leonid Gokhberg, Tatiana Kuznetsova, Anna Pikalova and Alexander Sokolov, and another report drafted by Chen Qiang, Zheng Shimin, Xiao Yi and Yang Yefeng; the India part is drafted by Shan Zuhua, Bi Liangliang and Xin

---

Bingqing; the China part is drafted by Huo Hongwei, Wang Zhongcheng and Li Wenjing, and the South Africa part is drafted by Wang Zhongyang, Zhang Dong and Ma Zongwen.

The third part is thematic reports, which features an in-depth analysis on hotspot issues related to STI. The experts of the High-level Expert Group are also involved in the drafting of this part. They have analyzed the current status and challenge of STI development in the country and offered targeted proposals for cooperation. Specifically, the reports in this part include four subjects: one on the innovation of digital economy drafted by Huang Maoxing, Tang Jie and Huang Xinhuan, one of energy technology innovation drafted by Zhang Shirong, Zhang Pei and Gao Mingyuan, one on technology innovation for promoting financial inclusion drafted by Zhao Xijun, Wei Boyang and Shao Mengzhu, and one on agricultural innovative competitiveness drafted by Guo Xiangyu, Wang Dan and Zhao Xinli. The detailed information on the level and potential of STI development in each BRICS country included in the report provides useful reference to help better understand the innovative competitiveness of BRICS countries.

The fourth part is the appendix, which introduces the relevant evaluation indicators and compiles the relevant documents of BRICS STI cooperation.

The report comprises near 200,000 words. Research Fellow Zhao Xinli, the Chair of the High-level Expert Group on BRICS STI Cooperation 2017, Deputy Director (DG level) of CSTECH and Academician of the International Eurasian Academy of Sciences, Professor Li Minrong, former Party Group Secretary of Fujian Provincial Administration of Press and Publication (Fujian Provincial Intellectual Property Office) and Director of China Institute of Science and Technology Evaluation, and Professor Huang Maoxing, Dean of the School of Economics of Fujian Normal University and Director of the Fujian Normal University Sub-center of the National Research Center of Comprehensive Economic Competitiveness are the chief editors of the book. The experts of the High-level Expert Group and their colleagues, the science and technology sections of Chinese embassies in BRICS countries, Russian Higher Schools of Economics and other BRICS think tanks on STI have jointly contributed to this project. Li Zhiqiang, Zheng Wei, Pan Hua, Chen Yuheng, Dai Le and Xia Huanhuan of CSTECH have translated the report.

The book has also made direct or indirect citations or references to the works of

---

other researchers. We express our deepest appreciation to the authors.

Due to time constraint and limited knowledge and experience of the drafting team, mistakes and errors are hardly avoidable. Your valuable opinions will be most appreciated.

Editors