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Russia and the New BRICS Countries

Potentials and Limitations of a Scientific and Technological Cooperation

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Irina DEZHINA

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Abstract

At the fifteenth BRICS summit, held in Johannesburg, South Africa, from August 22 to 24, 2023, a resolution was adopted to extend an invitation to six new countries to join the organization: Argentina, Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates (UAE). All of these countries except Argentina duly became members of BRICS in 2024, with the expanded group known as BRICS+. In addition to the political and economic advantages, it is assumed that the incorporation of these new countries could potentially facilitate their scientific and technological development.

From a legal and regulatory standpoint, however, BRICS is considered to be an informal forum, with no common rules or regulations. Indeed, studies of BRICS have identified regulatory inconsistencies as a problem in science and technology. Moreover, productive cooperation between the BRICS countries is being hampered by the use of different languages, divergent levels of funding, and a general diversity of interests in the sector. Although the group has now been in existence for 13 years, analysts are still emphasizing the need to select the most promising areas of priority research to be developed for the benefit of all BRICS countries while promoting educational and scientific mobility and boosting the research capacities of member states. It will be increasingly difficult to reconcile the various interests of the new countries, as they are more heterogeneous both in their levels of economic development and in their scientific and technological capacity. Nevertheless, the BRICS+ platform could serve as a catalyst for new “paired” links.

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Introduction

At the fifteenth BRICS summit, held in Johannesburg, South Africa, from August 22 to 24, 2023, a resolution was adopted to extend an invitation to six new countries to join the organization: Argentina, Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates (UAE). All of these countries except Argentina duly became members of BRICS in 2024, with the expanded group known as BRICS+.[1] In addition to the political and economic advantages, it is assumed that the incorporation of these new countries could potentially facilitate their scientific and technological development.

The state of science, technology, and cooperation in the "main" BRICS countries has been examined previously in sufficient detail. Scientific partnerships and their dynamics can usually be traced back through bibliometric data analysis.[2] Nevertheless, any such assessment of the new BRICS countries may prove to be misleading, as there is a possibility that various means of artificially increasing the number of publications[3] and citations[4] may be employed. Articles emanating from these countries are accordingly often withdrawn or retracted when errors are found in them or when falsifications are revealed. Among the major producers of scientific publications, three of the BRICS+ states (Saudi Arabia, Egypt, and Iran)

Translated from Russian into English by Cadenza.

1. In mid-January 2024, reports emerged that Saudi Arabia had still not joined BRICS officially, as a number of legal and regulatory issues remained unresolved. This issue affects all the new BRICS countries to a significant extent and is linked to technical reasons rather than political concerns. For an example of news coverage of the topic, see R. Romanov and I. Lakstygal, "Status Saudovskoi Aravii v BRICS okazalsya ne opredelen" [Saudi Arabia's Status within BRICS remains undetermined], *Vedomosti*, January 18, 2024, www.vedomosti.ru.

2. M. Kotsemir, "Dynamics of Russian and World Science Through the Prism of International Publications", *Foresight and STI Governance* (National Research University Higher School of Economics), Vol. 6, No. 1, 2012, pp. 38-58; S. Shashnov and M. Kotsemi, "Research Landscape of the BRICS Countries: Current Trends in Research Output, Thematic Structures of Publications, and the Relative Influence of Partners", *Scientometrics*, Vol. 117, 2018, pp. 1115–1155, https://doi.org; A. Sokolov, S. Shashnov, and M. Kotsemir, "From BRICS to BRICS Plus: Selecting Promising Areas of S&T Cooperation with Developing Countries", *Scientometrics*, Vol. 126, 2021, pp. 8815–8859, https://doi.org; E.V. Beskaravainaya and T.N. Kharibina, "Prospects for Relations of Russia with the BRICS Countries in the Sphere of the Natural and Exact Sciences", *Scientific and Technical Information Processing*, Vol. 50, 2023, pp. 121-128, https://doi.org.

3. M. Catanzaro, "Saudi Universities Lose Highly Cited Researchers After Payment Schemes Raise Ethics Concerns", *Science*, November 27, 2023, www.science.org.

4. K. Langin, "Vendor Offering Citations for Purchase Is Latest Bad Actor in Scholarly Publishing", *Science*, February 12, 2024, www.science.org.

find themselves among the eight countries with the highest number of retracted articles over the last twenty years.[5]

As a general rule, levels of innovation and technology in the main BRICS countries are assessed on the basis of patent statistics[6] and analysis of joint projects.[7] The most frequently conducted analysis pertains to the nature and scope of bilateral collaborations among the BRICS countries,[8] whether in specific technological fields[9] or in relation to certain subjects.[10] The patent-based approach is also applicable to the new BRICS countries.

An additional area of investigation is the examination of the principal strategic documents produced by BRICS member states in the domain of science and technology.[11] From a legal and regulatory standpoint, BRICS is an informal forum, with no common rules or regulations. The framework for scientific collaboration within BRICS is established through the adoption of regulations at meetings of national officials. Accordingly, one of the issues identified in the BRICS studies was the lack of consistency in the regulatory framework governing science and technology. Moreover, productive cooperation between the BRICS countries is being hampered by the use of different languages, divergent levels of funding, and a general diversity of interests in the sector. Although the group has now been in existence for 13 years, analysts are still emphasizing the need to select the most promising areas for research priorities to be developed for the benefit of all BRICS countries while promoting educational and scientific mobility

5. R. Van Noorden, "More Than 10,000 Research Papers Were Retracted in 2023 — A New Record", *Nature*, December 12, 2023, https://doi.org.

6. Chun-Yao T., "Technological Innovation in the Bric Economies", *Research-Technology Management*, Vol. 52, No. 2, 2009, pp. 29-35, https://doi.org.

7. Ye. A. Sidorova, "Innovatsionnoye razvitiye stran BRICS, predposylki i perspektivy sotrudnichestva" [The Innovation Development of the BRICS Countries: Preconditions and Prospects for Cooperation], *Vestnik mezhdunarodnykh organizatsii*, Vol. 13, No. 1, 2018, pp. 34-50, https://cyberleninka.ru; L. C. Kubota, "BRICS Cooperation in Science, Technology and Innovation: Progress to Be Shown", *Revista Tempo do Mundo*, No. 22, 2020, https://portalantigo.ipea.gov; I. Rensburg, S. Motala, and S. A. David, "Opportunities and Challenges for Research Collaboration Among the BRICS Nations", *Compare: A Journal of Comparative and International Education*, Vol. 45, No. 5, 2015, pp. 814-818, www.tandfonline.com.

8. R. Lema, R. Quadros and H. Schmitz, "Reorganising Global Value Chains and Building Innovation Capabilities in Brazil and India", *Research Policy*, Vol. 44, No. 7, 2015, pp. 1376-1386, https://doi.org; Jixiang G. and Jing J., "Scientific, Technological and Innovation Cooperation Between China and Russia in the New Era: Reshaping the Model and Choosing an Approach from the Perspective of Chinese Experts", *Studies on Russian Economic Development*, Vol. 33, No. 6, pp. 656-662, 2022, https://ideas.repec.org.

9. T. M. de Oliveira *et al.*, "International Cooperation Networks of the BRICS Bloc", Center for Open Science, 2018, https://ideas.repec.org.

10. Wang Y., "International Scientific Cooperation in the Arctic among the BRICS Countries", *Administrative Consulting*, No. 3, 2023, pp. 131-139, https://ideas.repec.org/.

11. G. V. Oleinik, "Natsionalnye interesy BRICS v sfere nauchno-tekhnologicheskogo sotrudnichestva" [BRICS National Interests in Science and Technology Cooperation], *Rossiiskii vneshneekonomichesky vestnik*, No. 3, 2023, https://cyberleninka.ru; M. Astakhova, "Scientific Cooperation Across the BRICS", *BRICS Law Journal*, Vol. 7, No. 1, 2020, pp. 4-26, https://doi.org; V. Kiselev and E. Nechaeva, "Priorities and Possible Risks of the BRICS Countries' Cooperation in Science, Technology and Innovation", *BRICS Law Journal*, Vol. 5, No. 4, 2018, pp. 33-60, https://doi.org/.

and boosting the research capacities of member states. It will be increasingly difficult to reconcile the various interests of the new countries, as they are more heterogeneous both in their levels of economic development and in their scientific and technological capacity. Nevertheless, the BRICS+ platform could serve as a catalyst for new "paired" links.

The BRICS+ assessments that have emerged with the accession of new countries thus far have not focused on science and technology. Instead, they have concentrated on the potential for market development, the emergence of a common currency, energy development, and the formation of areas of political influence. The issue of China's growing influence is being considered separately. Since the new BRICS countries joined, in particular the new African members, opportunities to take advantage of Chinese participation have been assessed while avoiding any risks of Chinese domination.[12]

Because of sanctions, plans have been drawn up in Russia to develop scientific and technological cooperation with the new BRICS countries. In light of the fact that certain erstwhile partners of Russia were instrumental in the imposition of sanctions, the imperative to accelerate technological advancement has become more pressing. This is because the country is seeking to reinforce its self-reliance and resourcefulness while simultaneously exploring new market opportunities. Achieving "technological sovereignty" was heralded as a new stage of technological development.[13] In May 2023, the Concept of Technological Development of Russia for the period until 2030 was approved.[14] The document defines what is understood by "technological sovereignty". It states that it is "the presence in the country (under national control) of critical, end-to-end technologies produced by its own development lines and with its corresponding production, ensuring the sustainable ability of the state and society to achieve their own national development goals and national interests". In February 2024, achieving technological sovereignty became one of the foremost challenges in Russia's updated Scientific and Technological Development Strategy,[15] while the previous guidelines under the 2016 Strategy were maintained for technological development in response to major challenges.

12. "BRICS+ Impact: Plaudits and Brickbats", *Economics Intelligence*, September 1, 2023, www.eiu.com.

13. A. Belousov, "Rossiya vkhodit v novy etap tekhnologicheskogo razvitiya" [Russia Is Entering a New Stage of Technological Development], Government of the Russian Federation, April 24, 2023, http://government.ru.

14. The Concept of technological development of Russia for the period until 2030, set out by Russian Government Order No. 1315-r, May 20, 2023, http://publication.pravo.gov.ru.

15. Decree of the President of the Russian Federation No. 145 of February 28, 2024, On the Strategy for Scientific and Technological Development of the Russian Federation, http://publication.pravo.gov.ru.

A plan of action has included the allocation of so-called technological sovereignty projects.[16] Thirteen project areas have been identified so far, each with lists of the key technologies. Some of them are existing foreign technologies which need to be developed independently.[17]

In the following study, we will examine the science and technology systems of the new BRICS countries and present our conclusions regarding the opportunities and prospects for Russia's cooperation with these nations.

16. Resolution of the Government of the Russian Federation No. 603 of April 15, 2023, On approval of priority areas for projects of technological sovereignty and projects for the structural adaptation of the economy of the Russian Federation and Regulations on the conditions for the attribution of projects to projects of technological sovereignty and projects for the structural adaptation of the economy of the Russian Federation, on the presentation of information on projects of technological sovereignty and projects for the structural adaptation of the economy of the Russian Federation and maintaining a register of the specified projects, and on the requirements for organizations authorized to issue opinions on the compliance of projects with requirements for projects of technological sovereignty and projects for the structural adaptation of the economy of the Russian Federation, http://publication.pravo.gov.ru.
17. V. Petrova and O. Sapozhkov, "Mysl s ogranicheniem po vysotye poleta" [A thought with an altitude restriction], *Kommersant*, April 10, 2023, www.kommersant.ru.

Economic characteristics of the new BRICS countries: Resources and attempts at diversification

In terms of gross domestic product (GDP), Saudi Arabia and Iran are the most economically developed of the new BRICS countries, and the populations of these countries are predominantly urban and literate. These two characteristics are shared by the UAE, which has the most urbanized population, with virtually 100% literacy (see Table 1). A major feature of all the new BRICS countries (Saudi Arabia, Iran, the UAE, and Egypt) is their dependence on exporting natural resources, especially oil and gas. In addition to its natural gas reserves, Ethiopia also possesses significant deposits of gemstones, gold, and platinum. Furthermore, industry accounts for more than a third of the GDP in Saudi Arabia, the UAE, and Iran.

Table 1. Socioeconomic characteristics of the new BRICS countries

Indicator	Saudi Arabia	Iran	Egypt	UAE	Ethiopia
Urbanization level (%) (2020)	84	76	43	87	22
Literacy level (%) (2021)	98	86	71	98	52
Mineral resources	Gas (5th in the world) Oil (2nd in the world)	Gas (2nd in the world) Oil (4th in world)	Gas (16th in the world) Oil Tantalum	Oil (8th in the world) Oas (7th in the world)	Gas Gold Platinum Precious stones
GDP, 2022 (billions of US dollars, 2015 prices)	761.1	482.9	453.8	427.9	105.8

Main sectors of the economy	Oil exports Tourism (income from pilgrimage to Mecca)	Services sector Oil exports	Tourism Logistics (operation of Suez Canal) Oil exports	Services sector Oil exports Tourism	Agriculture Textiles
Industry as % of GDP (2020)	41.3	35.3	33.3	40.9	24.2

Sources: UN Department of Economic and Social Affairs; World Bank; Trading Economics; Statistical Yearbook of Iran 2021-2022; Arab Development Portal; Egypt in figures; "Unpacking the Hajj Dividend for Saudi Arabia's Travel and Hospitality Industries", Arab News, June 30, 2023, www.arabnews.com; "Suez Canal Annual Revenue Hits Record $9.4 Billion, Chairman Says", Reuters, June 21, 2023, www.reuters.com; Statistical Yearbook, 2022 Edition, UN Department of Economic and Social Affairs, September 2022, pp. 231, 234-36, 240-41, and 243.

In Saudi Arabia, the oil sector accounted for 40.9% of GDP in 2022. The country also receives income from religious tourism (i.e., Muslim pilgrims traveling to Mecca and Medina), which totaled $31 billion in 2019.[18] In addition to its oil extraction and exports, the UAE has several other major revenue streams: the trade in materials such as aluminum, copper, and diamonds, tourism, and the re-export of goods such as tea, coffee, foodstuffs, mobile phones, and cars to countries in the Near East and Africa.[19] The country has an open trading regime with low import barriers[20] and has set a target of doubling its re-exports by 2030.[21] In Iran, aside from the oil and gas sector, the services sector plays a significant role, accounting for over half of GDP. A particular feature of Iran is that all decisions concerning development, including in science and technology, are made by the Islamic Revolutionary Guard Corps, which is a military-political organization, and science and technology are consequently under strict military and political control. In Egypt, as in Iran, the military-industrial complex plays a major role in the economy, with several sectors under its direct control.[22] The country's principal revenues come from services (including tourism), as well as duties levied on vessels passing

18. R. A. Proctor, "Unpacking the Hajj Dividend for Saudi Arabia's Travel and Hospitality Industries", *Arab News*, June 30, 2023, www.arabnews.com.
19. Sorp Group, "Reeksport v OAE" [Re-export in the UAE], https://sorp.ae.
20. United States Department of Commerce, International Trade Administration, "United Arab Emirates Country Commercial Guide", "Trade Barriers", July 26, 2022. For updated version, see www.trade.gov.
21. Government of the United Arab Emirates, "Mohammed bin Rashid Chairs UAE Cabinet, Approves 24 National Initiatives to Double Re-Export Within 7 Years", March 28, 2023, https://uaecabinet.ae.
22. I. Bocharov, "Egipetskaya ekonomika v tiskakh voyennykh" [Egypt's Economy in the Grip of the Military], Russian International Affairs Council, April 3, 2023, https://russiancouncil.ru.

through the Suez Canal.[23] Tourism's contribution to Egyptian GDP averaged around 12% between 2010 and 2022.[24] Agriculture underpins Ethiopia's economy, with the country specializing in the production of crops (cereals and coffee) and livestock.

The volume of high-tech exports as a proportion of exports overall serves as an indicator of development within the science and technology sector of the economy. According to data from the World Bank, levels of high-tech exports are low, ranging from 0.5% of overall export volumes in Saudi Arabia to 8-10% in the UAE. The new BRICS countries import high-tech goods in exchange for agricultural products and minerals. All of them import electronic devices, machinery, complex equipment, tools, and instruments, as well as vehicles. The economies of the countries concerned can, therefore, be said to have insufficient technological capacity.

In recent years, a number of emerging factors have had an economic impact (such as COVID-19 and new types of sanctions against various countries), disrupting well-established networks and value chains. Consequently, there is increasing interest in import substitution policies in some countries, especially Iran and Egypt, which have more militarized economies.

In Iran, import substitution is being implemented in a wide range of sectors, including the automobile and aviation industries, equipment manufacture, pharmaceuticals, and ICT, as well as in food security. In Egypt, import substitution is progressing in combination with the localization of production. Official publications speak of developing "local design" and of "manufacturing Egyptian products by means of technology". Import substitution in the country covers desalination technology, electronics, pharmaceuticals, waste treatment, and agricultural technology.

In Ethiopia, a strategy of import substitution began to be developed in the latter part of 2023, with the emergence of the National Import Substitution Strategy. This strategy is aimed at developing local production and import substitution in niche sectors.[25] These include goods for localized production, such as vehicle parts, aircraft components and spare parts, chemicals, plastics, and steel products.[26] Import substitution has not been explored in the UAE or Saudi Arabia.

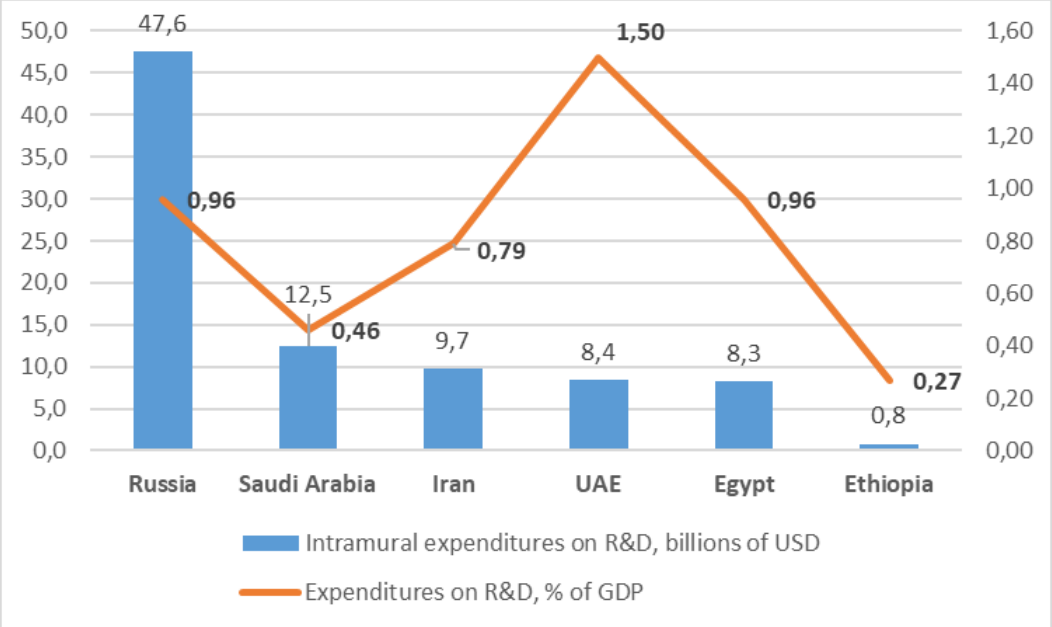
23. "Vyruchka operatora Suetskogo kanala dostigla rekorda v 2021-2022 fingodu" [Suez Canal Operator's Revenue Hits Record Level in 2021-22 Financial Year], Interfax, July 8, 2022.
24. "Egypt Tourism Revenues", Trading Economics, https://tradingeconomics.com.
25. A. Endale, "Import Substitution Strategy Targets Localizing Key Manufacturing within 3-10 Years", *The Reporter*, October 7, 2023, www.thereporterethiopia.com.
26. "Ethiopian Airlines to Manufacture Parts in Venture with Boeing", *Reuters*, August 18, 2023, www.reuters.com.

The weakness of scientific and innovation potential in the new BRICS countries

Scientific potential consists of several components, including funding for research and development (R&D), human resources, and ICT, material and technical capacity. It can also comprise assessments of scientific management systems.

The scientific potential of the countries under consideration is characterized by relatively low levels of expenditure on research and development (R&D), particularly when compared with Russia (see Figure 1). Even if the indicators for the share of GDP are higher than Russia's (as in the case of the UAE), the quantities are still extremely modest.

Figure 1. Domestic R&D expenditure at purchasing power parity: New BRICS countries and Russia, 2021 or closest year



Note: Data for countries is presented for the latest available year: 2017 for Ethiopia, 2019 for Iran, 2020 for Argentina, and 2021 for Egypt, Saudi Arabia, and the UAE.

Sources: Scientific indicators, 2023, statistical compendium, Moscow: National Research University Higher School of Economics, 2023, pp. 346 and 348; UNESCO Institute for Statistics (UIS), http://data.uis.unesco.org.

A salient feature of the scientific complexes in most of the emerging BRICS countries is the minimal role of business in R&D financing, with the state occupying a dominant position in this domain. The contribution of the business sector to overall R&D expenditure ranges from 4% in Egypt to 30% in Iran.[27] Business plays a significant role in carrying out R&D only in the UAE and Saudi Arabia (see Table 2). In Ethiopia and Egypt, companies make practically no investment in research and development. Budgetary resources are dominant in those countries, and higher education institutions carry out approximately 70% of all R&D work.

Table 2. Internal R&D expenditure by sector: Implementation in new BRICS countries and Russia, 2021 data (%)

Country	Businesses	Government	Higher education	Nonprofit organizations
UAE	61.9	25.4	12.6	0.0
Saudi Arabia*	39.0	58.0	3.0	0.0
Iran	25.1	40.3	33.6	0.9
Egypt	3.9	28.0	68.0	0.0
Ethiopia**	1.2	24.5	74.1	0.2
Russia	57.8	31.4	10.2	0.7

* 2022 data ** 2013 data

Sources: Scientific indicators, 2023, statistical compendium, Moscow: National Research University Higher School of Economics, 2023, pp. 353, 355; Ethiopian e-journal For Research Innovation and Foresight, Vol. 7, No. 1, 2015, p. 4; General Authority for Statistics, Saudi Arabia.

The availability of qualified personnel is another key characteristic of scientific potential. The UAE and Iran lead the way in the number of researchers per 1 million population,[28] with 2,500 and 1,700 full-time equivalent (FTE) research staff, respectively. Russia has a higher figure of 2,700 per million, although the new BRICS countries cannot be compared with Russia in absolute terms. In Russia, there are 390,000 researchers FTE, according to 2022 data, while in Iran, the country with the largest scientific infrastructure among the new BRICS countries, there are only 119,000, or a third as many. By way of comparison, the figure for Egypt is 68,000, and there are 23,000 researchers in the UAE.[29] The relatively

27. Scientific indicators, 2023, statistical compendium, Moscow: National Research University Higher School of Economics, 2023, p. 358.
28. Scientific indicators, 2023, statistical compendium, Moscow: National Research University Higher School of Economics, 2023, pp. 369 and 371; UNESCO Institute for Statistics (UIS), http://data.uis.unesco.org.
29. Scientific indicators, 2024, statistical compendium, Moscow: National Research University Higher School of Economics, 2024, p. 377.

high total number of research personnel in Iran may be explained by the need for self-reliance in technological development.

The practical impacts of scientific activity can be assessed through patenting, although it should be noted that patent statistics, like bibliometric analysis, are not a reliable measure of the practical usefulness of the research and development that has been conducted in catching-up countries. Their patents are often drawn up by way of a report on work that has been carried out without any further plans to commercialize the intellectual property. A more accurate assessment can be achieved by considering patents and patent applications that have been filed abroad. It is somewhat expensive to patent abroad, and then to maintain the patent,[30] and such levels of expenditure will be incurred only if there are plans to exploit the invention commercially. According to data from the World Intellectual Property Organization (WIPO), some of the new BRICS countries are oriented toward their domestic markets, while others tend to patent abroad (see Table 3).

Table 3. Patents applied for in country and abroad, new BRICS countries and Russia, 2017–2022

Country	No. of patents granted	2017	2018	2019	2020	2021	2022
Egypt	Total	148	240	50	115	129	148
	Granted in country	96	160	0	65	63	88
	Abroad	52	80	50	50	66	60
Ethiopia	Total	1	1	0	1	1	6
	Granted in country	1	1	0	1	0	5
	Abroad	0	0	0	0	1	0
Iran	Total	3,726	3,057	2,580	3,444	2,788	2,144
	Granted in country	3,668	2,993	2,484	3,294	2,704	2,051
	Abroad	58	64	96	150	84	93
Saudi Arabia	Total	2,905	3,488	2,956	2,819	2,317	2,438

30. The cost of registering a patent can range from around $1,500 to $3,000. The costs of maintaining a patent depend on its duration and may be measured in thousands of dollars. See, for example, “Patenty v SShA: protsedura, sroki i stoimost” [Patents in the USA: Procedures, Terms, and Costs], Crane IP, https://craneip.com.

	Granted in country	368	456	284	300	373	550
	Abroad	2,537	3,032	2,672	2,519	1,944	1,888
UAE	Total	271	319	389	295	376	318
	Granted in country	14	11	11	3	3	11
	Abroad	257	308	378	292	373	307
For reference: Russia	Total	24,809	23,627	23,381	21,311	19,192	20,456
	Granted in country	21,370	20,772	20,373	17,512	15,342	15,758
	Abroad	3,439	2,855	3,008	3,799	3,850	4,698

Source: WIPO IP Statistics Data Center, https://www3.wipo.int.

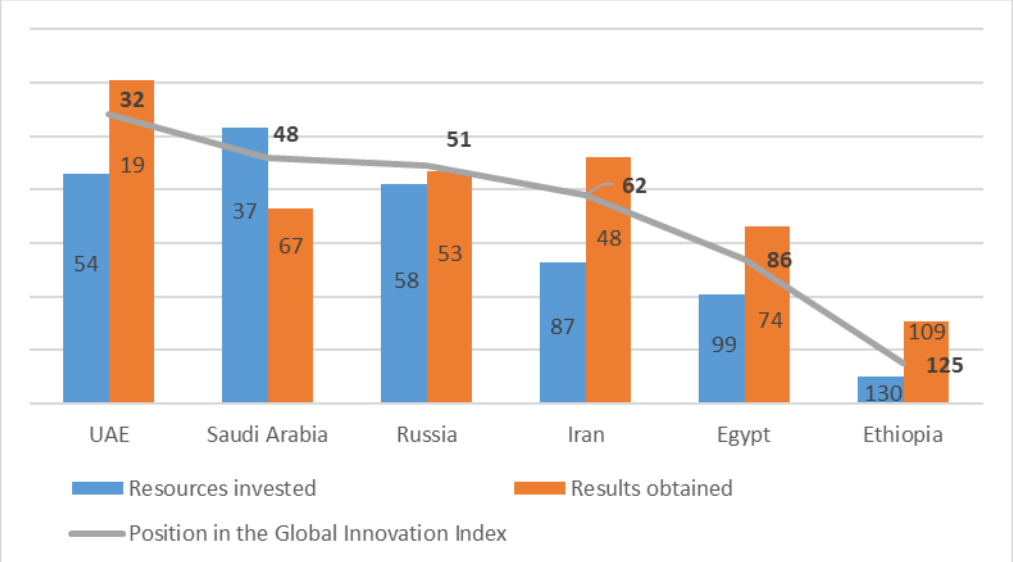
Saudi Arabia and the UAE mainly patent abroad, while Egypt is in an intermediate position, and Iran is locked into its domestic market. It should be noted that, like Iran, Russia is oriented toward its own domestic market. The same indicator is not informative for Ethiopia, given that it pursues practically no international patenting. Saudi Arabia and Iran are significantly ahead of the other countries in the group when it comes to the extent of their patenting, although they still fall well behind Russia, by a factor of eight to ten.

To eliminate economies of scale, patenting rates can be considered per 1 million inhabitants of a country. Iran and Saudi Arabia score the highest according to this measure for 2022, with 93 and 72 patents per million, respectively. The UAE lags behind Saudi Arabia by a factor of 14, while Egypt and Ethiopia have negligible figures for the number of patents per million people. Hence, only Iran and Saudi Arabia may be said to have the potential to develop their own technologies. There are overlaps in the different countries' priority areas when it comes to the product specialization of patents. In most countries, the largest number of patents may be found in medical technology, pharmaceuticals, measuring equipment, and various types of chemical products. Hence, even with such different scales of inventive activity in the BRICS+ countries, there are clearly some similar priority technological sectors where resources are being invested. In such areas, cooperative projects may be initiated with greater ease.

Innovation processes in the BRICS+ countries: Strengths and weaknesses

Judging by the indicators for the new BRICS countries in science and technology, it may be assumed that their innovation systems are insufficiently developed—although, according to data from WIPO's Global Innovation Index, Saudi Arabia and the UAE are ahead of Russia in the ranking of countries by levels of innovation development (see Figure 2). The UAE and Iran have the best indicators for the ratio of results obtained to resources invested. According to 2023 data, these two countries rank 19th and 48th by performance, respectively, despite their significantly lower positions in terms of available resources, and they can, therefore, be considered to be somewhat efficient in obtaining returns on investment in innovation development. Egypt and Ethiopia have the least developed innovation systems in terms of both resources and results. Russia finds itself around the middle of the range, at the 58th spot for resources invested and in the 53rd position for innovation performance.

Figure 2. Ratings for resources invested and results obtained for Russia and countries joining BRICS, and their positions in the Global Innovation Index, 2023



Source: WIPO, Global Innovation Index (GII), 2023, www.wipo.int.

An examination of the individual indicators that comprise the innovation index enables the identification of the strengths and weaknesses inherent to the innovation systems in the new BRICS countries (see Table 4).

Table 4. Top three weaknesses and strengths of established innovation systems in countries admitted to BRICS, 2023

Weaknesses	Strengths
Egypt	
Quality of state regulation	Energy efficiency in relation to GDP
Gross national investment, % GDP	Size of domestic market
Trade tariffs	Labor productivity growth, %
Ethiopia	
Access to and use of ICT and government online resources	Labor productivity growth, %
Environmental sustainability (compliance with ISO 14001)	High-tech imports as % of the volume of trade
Share of women with higher education in the national economy, %	Imported ICT services as % of the volume of trade
Saudi Arabia	
Slowing labor productivity growth, %	Access to and use of ICT
Imported ICT services as % of the volume of trade	Development of innovation clusters
Own trademarks	Entrepreneurial policy and culture
UAE	
Own patents, billions of dollars	Conditions for doing business
Own trademarks	Access to ICT
Own industrial design	Share of research in the business sector
Iran	
Stability of institutions as a business environment	Own trademarks
Business policy	Own patents, billions of dollars
Quality of state regulation	Software costs, % GDP

Source: WIPO, Global Innovation Index (GII), 2023, www.wipo.int.

Iran and Egypt are distinguished by the dearth of effective government regulation and business policies, including the absence of meaningful government support measures. We should note, once again, that this may be related to the significant control exercised through the military-industrial complex in these countries. However, the respective strengths in these countries are quite different. In Egypt, the strongest features are energy efficiency and the size of the domestic market (which has potential for growth); Iran has its own patents, trademarks, and software.

Unlike Iran, Saudi Arabia and the UAE are particularly let down by an insufficient number of their own trademarks and patents, and by a shortfall in industrial design capacity, which is entirely consistent with a re-export policy and a reliance on exporting natural resources. The strong points for these two countries include policies that encourage businesses to innovate and good availability of technology infrastructure and ICT.

Ethiopia is something of an outlier and is the weakest of the new BRICS countries in science and technology development. There are serious problems here, even with access to ICT, and companies tend not to comply with environmental standards. There are few women with higher education in the Ethiopian economy. Women's representation is now being considered as an indicator of progress. On the plus side, Ethiopia is considered to have the potential to increase its labor productivity, and it has relatively high indicators for both high-tech and ICT services imports, which could be viewed as a basis for further development in the country.

Science and technology development plans

Each of the countries considered here, irrespective of the size of its science and technology capacity, is pursuing some sort of science and technology policy and identifying priority areas for support.

The main principles of Iran's science and technology policy were formulated in the "Iran Vision 2025", which was adopted in 2005. This The 20-year plan set out a series of ambitious goals, including bringing expenditure on R&D up to 4% of GDP[31] while increasing the proportion of funding from the business sector to 50%. Plans were therefore made to increase activity in patenting and publications. The main objective set for the country's National science and technology policy, approved in 2015, was to strengthen the links between higher education, science, and other sectors of the economy.[32] A wide range of areas were assigned as priorities in Vision 2025: bio and nanotechnology, ICT, composites, oil and gas, energy, hydrogen fuel cells, satellite systems, marine technology, and the automotive industry.

Saudi Arabia adopted a National Science, Technology and Innovation Plan covering the period from 2012 to 2025, and the "Saudi Vision 2030" program, launched in 2016, in which the emphasis is on technological development. The country has plans to develop nuclear and renewable power to ensure an energy transition and to reduce its dependence on the oil industry, while also seeking to make progress on water purification technology, agro- and biotechnology, state-of-the-art materials, nanotechnology, ICT, medicine, electronics, and space technology.

According to two complementary documents issued by the UAE, the National Innovation Strategy, produced in 2014, followed by the Emirates Science, Technology and Innovation Policy in 2015, the range of priorities is significantly narrower than in Saudi Arabia. Indeed, this is entirely consistent with the country's orientation toward re-export. Important for the UAE are the development of renewable energy sources, ICT, and biomedicine.

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31. This level of expenditure is currently only achieved in two countries in the world: Israel and South Korea.

32. United Nations Conference on Trade and Development (UNCTAD), *Science, Technology and Innovation Policy Review: Islamic Republic of Iran*, New York and Geneva: United Nations, 2016, https://unctad.org.

Egypt's science and technology policy priorities are reflected in the "Sustainable Development Strategy: Egypt Vision 2030", launched in 2016, and in the National Strategy for Science, Technology and Innovation 2030, published in 2019. These documents state that R&D investment in Egypt should ensure food security and self-sufficiency, while helping to develop the means to curb the spread of diseases and protect the environment.[33] Particular attention was given to the development of ICT (especially digitization and cybersecurity).[34]

Ethiopia's Science, Technology and Innovation Policy was adopted in 2010, nearly 14 years prior to the writing of this review, setting the challenge of adapting imported technologies. In other words, technology policy is based on the transfer of the foreign technologies most required by the country.[35] In 2021, a new vision for the country's development was adopted: "Ethiopia 2030: The Pathway to Prosperity Ten Years Perspective Development Plan (2021-2030)", which emphasizes the importance of developing energy technologies and renewable energy sources, as well as ICT.[36]

An analysis of science and technology policy documents reveals that the declared countries' priorities are similar: energy, medicine, and ICT. To a certain extent, this has been to follow the trends set in developed countries, yet with an inability to provide the necessary resources for all these areas of development.

Thus, what most of the new BRICS countries have in common is that they have not relied on domestic capabilities for their S&T agenda. Consequently, they have become dependent on external sources of expertise and technology. They are all marked by modest levels of R&D investment, the determining role of the state budget, a relatively low level of business activity, and, consequently, modest practical returns from R&D. Iran is pursuing its own particular developments in the sphere of innovation. The other countries claim to have more serious intentions to develop their own technology capacity than they actually have, as evidenced by the little attention given to import substitution policy.

33. S. Volkov, "Scientific and Technological Development of Egypt in the XXI Century", *Journal of the Institute for African Studies*, Vol. 4, No. 53, 2020, pp. 43-54. https://africajournal.ru.
34. Government of Egypt, Ministry of Communication and Information Technology, "Egypt ICT Strategy", https://mcit.gov.eg.
35. Government of Ethiopia, "National Science, Technology and Innovation Policy: Building Competitiveness Through Innovation", 2010, https://faolex.fao.org.
36. Ethiopia, Planning and Development Commission, *Ethiopia 2030: The Pathway to Prosperity Ten Years Perspective Development Plan (2021-2030)*, Addis Ababa: 2021, available via the database of the UN Food and Agriculture Organization (FAOLEX Database) at: https://faolex.fao.org.

Prospects for cooperation between Russia and the new BRICS countries

In Russia, international cooperation has not been marginalized; rather, it has been recognized as a crucial element in the pursuit of technological sovereignty. The ability to maintain technological independence is contingent upon the input of foreign expertise and participation.[37] An initial reorientation toward countries such as China and India has already become evident. According to preliminary data, China became a major scientific partner for Russia in 2023, accounting for 19% of joint publications[38] and overtaking the United States and Germany, which had previously accounted for the highest numbers in this regard. Cooperation with the African Union (AU), the intergovernmental organization founded in 2002 comprising 55 countries on the African continent, has also been recognized as promising. The AU's influence may grow in the foreseeable future. Indeed, following the G20 summit in New Delhi,[39] the AU was invited to join the group in September 2023. Three of the BRICS+ countries are members of the African Union: South Africa, Egypt, and Ethiopia, with South Africa and Egypt being among the major donors to the AU.

During the second Russia-Africa summit in Saint Petersburg in July 2023, it was stated that Russia has scientific output and technologies that could be of interest to countries in Africa. The main vector of development here lies in the applied sphere, specifically through interaction between Russian companies and African states,[40] with Russian firms prepared to offer their solutions to African partners.[41] Among the new BRICS countries, Egypt and Ethiopia, hence, began to be viewed as promising partners. Certainly, as this study has shown, Saudi Arabia and

37. I. G. Dezhina and S. V. Egerev, "Technological Leapfrogging: Theory and International ICT Practices", *Outlines of Global Transformations: Politics, Economics, Law* (Center for Crisis Society Studies), Vol. 15, No. 3, 2022, pp. 6-23, available in Russian at: www.ogt-journal.com; English abstract available at: https://ideas.repec.org.

38. M. Kotsemir, E. Streltsova and M. Filatov, "Publication Activity of Russian Scientists in the New Realities", *Science. Technologies. Innovations. Express-information*, December 11, 2023, https://issek.hse.ru.

39. A. Lenin, "'Gruppa dvadtsat'. Vsye, chto nuzhno znat o G20" (The Group of Twenty: All You Need to Know About the G20), *Rossiyskaya Gazeta*, September 7, 2023, https://rg.ru.

40. Second Summit, Russia-Africa Economic and Humanitarian Forum, "Russia and Africa: Science, Education, and Innovation for Economic Development", 2023, https://summitafrica.ru.

41. Roscongress, "Achieving Technological Sovereignty Through Industrial Cooperation", Second Summit, Russia-Africa Economic and Humanitarian Forum, July 27, 2023, https://roscongress.org.

the UAE have no plans to pursue import substitution. Russia's collaboration with Iran, despite the potential for significant mutual benefits, is constrained by the sanctions regimes that pertain to both countries.

Egypt's own technologies are poorly developed, as is revealed by patenting statistics, although the country could still become a promising medical and pharmaceutical market for Russia. As for joint activities involving Russia and Ethiopia in the science and technology field, a medium-term program for the development of trade, economic, scientific, and technical cooperation between the two states was approved in 2002.[42] The program identifies an extremely wide range of priority areas for scientific and technological cooperation, covering industry, agriculture, energy, geology, water management, healthcare, and the provision of training at a national level. In addition to all of this, there are plans to extend cooperation to biological research for agriculture[43] and digital technologies.[44] Russia and Ethiopia, hence, signed an agreement in July 2023 to establish a joint biological research center for genomics and agrobiology.[45] In view of Ethiopia's focus on borrowing technology, cooperation between the two countries is set to involve the transfer of Russian technological solutions, with assistance provided in adapting them.

Despite Egypt and Ethiopia being, in a sense, Russia's "favorites" among the new BRICS countries, opportunities for cooperation in science and technology are limited by these countries' modest potential. While such attempts on the part of Russia to diversify its partners are understandable, it would be more fruitful to cooperate with equal partners, with those at a higher level, or with those who possess complementary expertise. In science and technology, cooperation means partnership, rather than just a relationship that involves helping and receiving assistance. While relationships with the new BRICS countries are undoubtedly possible, they are unlikely to strengthen Russia's science and technology sphere.

42. Resolution of the Government of the Russian Federation No. 842 of November 28, 2002, On the Signing of the Medium-term Program for the Development of Trade, Economic, Scientific, and Technical Cooperation between the Russian Federation and the Federal Democratic Republic of Ethiopia.

43. W. Aregahegn, "Russia — Ethiopia Cooperation in Areas Of Science, Technology and Education Gaining Momentum: Ambassador", *Fana Broadcasting Corporate*, April 26, 2023, www.fanabc.com.

44. "News: Russia to Increase Cooperation with Ethiopia in Info. Network Security, Digital Skills", *Addis Standard*, December 2, 2022, https://addisstandard.com.

45. Ministry of Science and Higher Education of the Russian Federation, "Rossiya i Efiopiya podpisali soglasheniye o sozdanii sovmestnogo tsentra biologicheskikh issledovanii" (Russia and Ethiopia Sign Agreement on Establishment of Joint Biological Research Center), July 27, 2023, https://minobrnauki.gov.ru.

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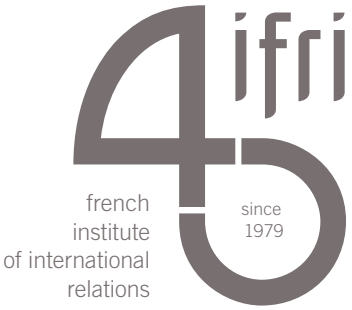

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