Building a BRICS framework for science, technology and innovation

The BRICS countries have come a long way in terms of science and related fields, but there is still much that the group could do concerning multilateral cooperation to encourage innovation and address its members' common challenges

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Brazil, Russia, India, China and South Africa are among the biggest, fastest-growing emerging markets. In the aftermath of the recent financial crisis in Europe and the accelerated reconfiguration of a new geography of growth, new players have emerged from countries that are not members of the Organisation for Economic Co-operation and Development (OECD).

Indeed, the BRICS countries have made substantial progress in science, technology, innovation and industrial performance. However, their growth strategies may not be sustainable unless they address common problems in moving to innovation-based development. These include lagging infrastructures and healthcare systems, and inequalities in access to education and income distribution. Furthermore, the emerging economies must adapt and coordinate their policy agenda. Policies are required to reflect changes in patterns of innovation, such as the growing importance of non-technological innovation, the pervasiveness of open innovation, and increasing multidisciplinarity and allied technology convergence.

Innovation-based growth is increasingly considered a response to economic, social and environmental pressures. Strengthening cooperation among the BRICS countries is, therefore, crucial.

BRICS summits since 2009 have formulated a policy framework for cooperation in science, technology and innovation, but it has been limited to meetings, conferences and publications. The announcement of priorities in 2011 was a step forward. It included joint activities in microelectronics, bio- and nanotechnologies, energy efficiency and renewable energy, food, sustainable agriculture and the use of natural resources. It emphasised the responsibility to make these technologies available to developing countries, integrate traditional knowledge and advanced technologies, increase the food productivity of smallholders and improve socioeconomic development conditions in rural areas.

Despite their overall positive evolution in science, technology and innovation, the BRICS countries still lag behind developed economies. Shared, common challenges include low levels of business engagement in innovation, inadequate commercialisation of research and development (R&D), weak links within national innovation systems, insufficient demand for innovation, sectoral imbalances, inefficient use of natural resources, socioeconomic cleavages and uneven involvement of populations.

These structural disproportions lead to an unsustainable model of BRICS integration into the global economy, as suggested by five indicators identified by the OECD and the Royal Society.

Areas of excellence should be identified. Solutions might draw on economies of scale for R&D-based solutions, and partnerships in environmental technology transfers

Broad scope for improvement

First, the BRICS members' considerable growth rates and ratios of corporate and government R&D funding to gross domestic product (GDP) are below OECD averages. As for industry-financed gross expenditure on R&D relative to GDP, only China can be compared to OECD countries.

Second, the impact of scientific publications and the extent of international scientific collaboration within BRICS is below average.

Third, although the BRICS contribution to the global scientific literature has been rising rapidly, the number of articles published in top-quartile journals remains below average. However, in terms of total publications, independent of quality, China holds the second position after the US.

Fourth, despite an increase in the number of triadic patent families (the same invention disclosed and patented by an inventor in Europe, the US and Japan), the BRICS share is almost 10 times smaller than that of the European Union, Japan and the US. However, the BRICS countries attract foreign patents: more than 40 per cent of OECD members' inventions are protected in China, and the percentage of patents with foreign co-inventors for every BRICS member is above average.

Fifth, the brain drain of qualified human resources remains a common problem. For instance, 70 per cent of Chinese people who studied abroad between 1978 and 2006 did not return to China.

Multilateral cooperation can provide the BRICS countries with opportunities to address the common failures of their national innovation systems – through using cumulative expertise and

Brazil's science minister, Aloizio Mercadante, and the president of Ford Brazil and South America, Marcos de Oliveira, applaud the launch of the company's first global model designed and developed entirely by its South American team. The BRICS framework should foster demand for innovation

resources, sharing best practices and coordinating their actions.

First, BRICS should ensure a strategic, coherent and operational framework for developing science, technology and innovation. It would include an action plan with objectives, implementation mechanisms, institutional arrangements and specific programmes. It would involve joint strategic intelligence exercises to map R&D needs and assess strengths and weaknesses. Complementarities should be a priority. The overall policies should encourage demand for innovation in all sectors, and stimulate new sectors and non-technological innovations. And the plan should foster innovation-based, inclusive growth. A common agenda should be integrated in BRICS countries' national and international strategies to address socioeconomic inequalities and environmental challenges.

Second, BRICS should encourage the exploitation of synergies. Policies aimed at building capacity in science, technology and innovation will contribute to a move up the global value chain. Areas of excellence should be identified. China, Russia and India are inclined towards engineering. Brazil and South Africa tend towards agriculture, biosciences and medicine. They are active in patenting in waste management, water pollution and renewable energy. Six of the world's 50 high-impact universities in pharmacology and toxicology are located in China, with one in Brazil. Human resources development in science and technology is uneven, as China and Russia are better positioned than other members. National technological specialisation also matters. China specialises in information and communication technologies (ICT) and bio- and nanotechnologies. Russia is also strong in bio- and nanotechnologies. Other features are China's global manufacturing capacity and India's leading supply of services. Efficient solutions might draw on economies of scale for R&D-based solutions and partnerships in environmental technology transfers.

Public-private partnerships

Third, stimulating R&D collaboration and commercialisation will require cost-sharing mechanisms for joint investment in basic and pre-competitive research, as well as funding schemes for joint programmes. Funding must be diversified, with increased corporate involvement and the creation of venture capital institutions. Technology transfer and the development of knowledge markets must be stimulated, removing barriers to trade and investment, promoting technology alliances and encouraging technology commercialisation and transfer. A framework for public-private partnerships should be established to exploit R&D results and technology transfer.

Fourth, infrastructure for collaboration would improve intellectual property rights to facilitate knowledge exchange and technology transfer, develop facilities for mutually beneficial R&D, and promote links between R&D, education and industry. It would ensure effective customs and tax policies on scientific materials and instruments, promote international networking among R&D institutions and universities, and ensure effective mechanisms for information exchange.

Fifth, a regulatory framework that fosters labour mobility is required, involving visa policies, scholarships, research and travel grants, internship programmes and academic exchanges.

Finally, evidence-based innovation policies should be supported, with joint data collection on indicators, international collaboration and BRICS macroeconomic performance. Regulation of science, technology and innovation should be performance-oriented, with results-based budgeting, established quantitative and qualitative programme indicators, regular monitoring and performance evaluation. ■