DOI: 10.52950/3OSC.Istanbul.2023.5.018

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MARKETING OF BRICS INNOVATION CLUSTERS IN THE CONTEXT OF GEOPOLITICAL INSTABILITY

Abstract:

The modern stage of society development is characterized by an increased attention to the issues of formation and development of national innovation systems (NIS), which would ensure the integration of various elements of the innovation process, thereby contributing to the build-up of the country's competitive advantages in the global market. Independent development of countries in modern economic conditions is not possible due to the complexity and turbulence of the external economic circuit. In the new geopolitical realities, the fact that past globalization paradigms are no longer having an impact on the viability of the NIS of many countries is becoming evident. At the same time, due to the changing geopolitical landscape, the role of international associations, such as BRICS, is being significantly transformed and they are becoming new centers of influence, including in matters of scientific and technological cooperation.

One of the priority conditions for the effective functioning of international S&T cooperation networks and the NIS of each individual country is the creation and maintenance of innovation infrastructure. Already functioning innovation clusters with technology parks, business incubators, accelerators, etc. can become such an infrastructure. Cluster structures are the most effective form of development of international scientific and technological cooperation, which allows to fully realize the potential of countries and structures involved in the interaction, as well as to obtain a significant synergistic and multiplicative effect. The issues of marketing support of innovative cluster associations, which contribute to the successful promotion of clusters in the professional community and target markets, are of particular relevance in this issue.

Keywords:

innovation clusters, BRICS, marketing, geopolitical instability

JEL Classification: M31, O32, F02

Introduction

The effective use of innovation potential by countries is a fundamental factor for their stable economic development, increased competitiveness in the global market, and the establishment and development of national innovation systems (NIS).

Issues of scientific and technological development are currently of particular relevance due to the need for a breakthrough in the digital transformation of the economy and the transition to a new technological stage, that is, the fourth industrial revolution.

Independent development of countries in modern economic conditions is not possible due to the complexity and turbulence of the external environment. This is especially true for such a sphere, as innovative development. It is impossible to achieve progress without co-operation in this area of economic activity.

At present, many countries, realizing the importance of innovative development for their own growth, have initiated a kind of "innovation race", creating innovation clusters in which economic agents benefit from strategic partnerships, being at the same time in a state of cooperation and competition.

New institutional structures, such as the BRICS group of countries, are gaining a special role in the modern global economy. Cooperation with the BRICS countries has increasingly become a priority in recent years in a variety of areas, especially in science, technology and innovation.

At present, the BRICS partnership is developing in various strategic directions, one of the priorities being scientific and technological cooperation, in particular, the development of joint innovation clusters. In these ecosystems, human resources, capital and know-how are seamlessly mobile, and transaction velocity is driven by a relentless pursuit of incremental funding opportunities and short business model cycles.

Innovation clusters are global economic «hotspots» where new technologies are developing at astonishing speed and where the pooling of capital, expertise and talent is fueling the development of new industries and new ways of doing business.

Innovation clusters can be defined as “engines" of innovative development (Keane, 2013). Michael Porter described business clusters as the geographic concentration of a critical mass of interrelated companies and institutions in a particular area, "where proximity leads to shared advantages through the pooling of expertise and specialized resources”.

Engel and del Palacio extend Porter's definition of industrial agglomeration to outline a global cluster of innovation, which describes business clusters that are not primarily defined by sectoral specialization, but by the stage of development and innovation that make up the cluster. While industry concentrations do exist, they are not definitive. Rather, what differs is the nature and behavior of the components - the rapid emergence of new firms commercializing new technologies, creating new markets and entering global markets (Engel J.S., J. del-Palacio, 2009).

The creation and development of innovation clusters and other basic innovation infrastructure is becoming a key objective in order to intensify international scientific and technological cooperation among the BRICS countries. One of the priority roles in this process is marketing and successful positioning of scientific developments and research.

Research Materials and Methods

The key method of this study is a content analysis of open sources of information such as the BRICS strategic documents on national innovation systems, materials of the BRICS Working Groups on International S&T Cooperation, statistical materials of the World Intellectual Property Organization (WIPO), Global Innovation Index, Patent Cooperation Treaty (PCT), other open-print data.

There is a growing body of research on S&T cooperation, innovation clustersamong the BRICS countries. Among foreign researchers, the works of John Kirton, Jim O'Neill, and Caroline Bracht should be noted. Research in this area has also been conducted by Russian scientists. The works of A.V. Biryukov, S.A. Gusarova, E.A. Degtereva, I.V. Danilin, L.N. Krasavina, M.V. Larionova, A.V. Malgin, Y.N. Moseikin, A.G. Pikalova, G.D. Toloraya, B.A. Kheifets are of interest.

Results

As such, an innovation cluster is a group of interconnected enterprises and organizations located in a certain territory and carrying out innovative activities on the basis of a contract.

Regardless of the country of its formation and location, an innovation cluster, as a unit of socio-economic development of a country, has the following specific features that allow to differentiate it from other isolated instruments of innovative development:

a) synergy with educational and research institutions;

b) support from public institutions;

c) access to funding;

d) the presence of multinational companies;

e) the presence of an extended interpersonal communication network;

f) shared values and convergence of interests;

g) mobility of human resources;

h) focus on achieving global goals;

i) focus on the development of a super-innovation cluster (Masyuk N.N., Bushueva M.A., Zheng Fuxue,2021)

Each country has several large centers of innovation that link the national innovation system to global innovation networks. At the same time, it is the national policy of openness to knowledge and international co-operation that is perhaps one of the main factors that allow the national economy to integrate into the global economy more effectively, increasing competitiveness.

A characteristic feature of the current stage of innovation landscape development is the emergence of two parallel trends: at the global level and at the regional level (i.e. formation and development of niche clusters and concentration of innovation activity at the level of regions/cities).

Table 1: Main tasks of development of innovative territorial clusters of different types and priorities of their support

Objectives of cluster development	Priorities of support
Clusters formed on the basis of "anchor" high-tech enterprises	
• Development of innovation, production, transport and energy infrastructure, energy infrastructure • Search for new markets and areas of application of existing competences, overcoming orientation towards traditional markets with low growth rates. • Overcoming dependence on state orders, technological backwardness, implementation of the "open innovation" model	Formation of an "innovation belt" of small and medium-sized companies, universities and scientific organizations around large enterprises Introduction of advanced methods of production organization, development of outsourcing and supplier systems Improvement of existing technological chains through support of an "optimization" nature
Clusters formed on the basis of leading scientific and educational centers	
• Formation of a "project stream" - high-tech start-ups created by graduates of universities - cluster participants • Development of youth innovative entrepreneurship • Reaching the world level of competitiveness in the sphere of • Education and science, including through the development of cooperation with leading foreign universities and research centres. • Increasing the share of breakthrough research and development of the world level • Development of cooperation with industrial enterprises	Attracting large companies to organize high-tech production on the basis of the existing human resources potential and research infrastructure Development of "serial" innovative entrepreneurship through commercialization of developed technologies Personnel training, formation and development of new scientific areas research areas Launching the latest high-tech production facilities
Clusters formed on the basis of small and medium-sized innovative businesses	
• Development of human resources potential, attraction of highly qualified specialists • Development of entrepreneurship in the field of innovations (including at early stages) • Formation of consortiums and joint projects to enter new markets, including access to large-scale procurement of large-scale products. • Formation of consortia and joint projects to enter new markets, including access to procurement by large companies and public procurement.	Development of an "innovation ecosystem" and common services, including innovation infrastructure Stimulating demand for innovative products of small and medium-sized businesses Development of intra-cluster cooperation, including the involvement of scientific and educational organizations.

Source: Contribution of the BRICS STIEP Working Group

To better define the points of innovation integration, it is necessary to identify the strengths of each country in the BRICS.

Several organizations are engaged in research activities to measure the innovativeness of economies. One of the main projects on this topic is the Global Innovation Index (GII).[1] The annual Global Innovation Index report provides insights into the spatial distribution of innovation activity. In particular, it identifies the world's most dynamic clusters of scientific and technological specialization.

The Global Innovation Index traditionally focuses on countries' innovation activity and development, which is determined by a number of factors such as national policies, legislation, federal expenditure on innovation, etc. Each country has its own peculiarities in the organization of innovation activity, but as a rule, innovation activity is geographically concentrated in certain centers (clusters), which are concentrated in one city or a group of cities.

BRICS countries are at varying degrees of innovation. The Global Innovation Index ranks the world's economies according to their innovation capabilities as well as multidimensional aspects of innovation, which are assessed by some 80 indicators, which are divided into two sub-indices: "input" indicators (inputs to create innovation) and "output" indicators (the result of the of innovation). The "input" indicators are represented by the groups: "Institutions", "Human capital and research", "Infrastructure", "Level of market development", "Level of business development". The result, "output", is assessed by 2 groups of indicators: "Scientific results" and "Creative results".

In the overall ranking of countries by the level of development of innovation activity, the BRICS countries have rather disjointed indicators, where the leader, according to 2022 data, is China, occupying the 11th line of the rating. Russia (47), India (40), Brazil (54) occupy approximately similar positions in the ranking, with South Africa (61) slightly behind.

Table 2: BRICS countries' positions in the Global Innovation Index, 2022

Country	GII rank	Score	Region rank
Brazil	54	32.5	2
Russia	47	34.3	30
India	40	36.6	1
China	11	55.3	3
South Africa	61	29.8	2

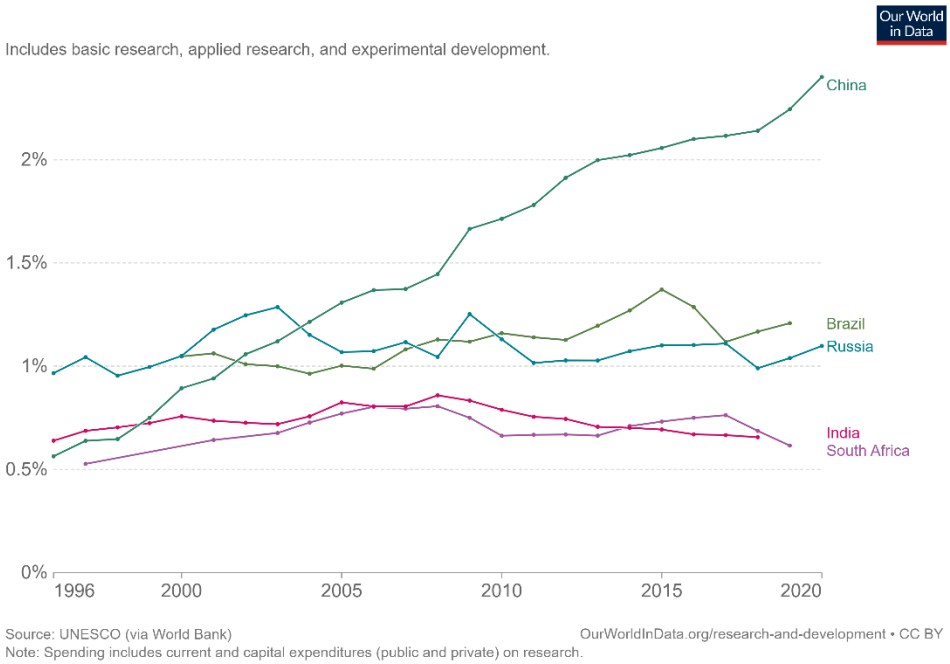
Source: Global Innovation Index (GII), 2022

In order to assess the innovation potential of the BRICS countries in more detail, it is necessary to consider the countries' main indicators on science and technology.

One of the main indicator is «Research and development spending as a share of GDP».

[1] Global Innovation Index (GII), 2022 at: https://www.globalinnovationindex.org/Home (accessed 30 July 2023)

Fig. 1. Research and development spending as a share of GDP (%)

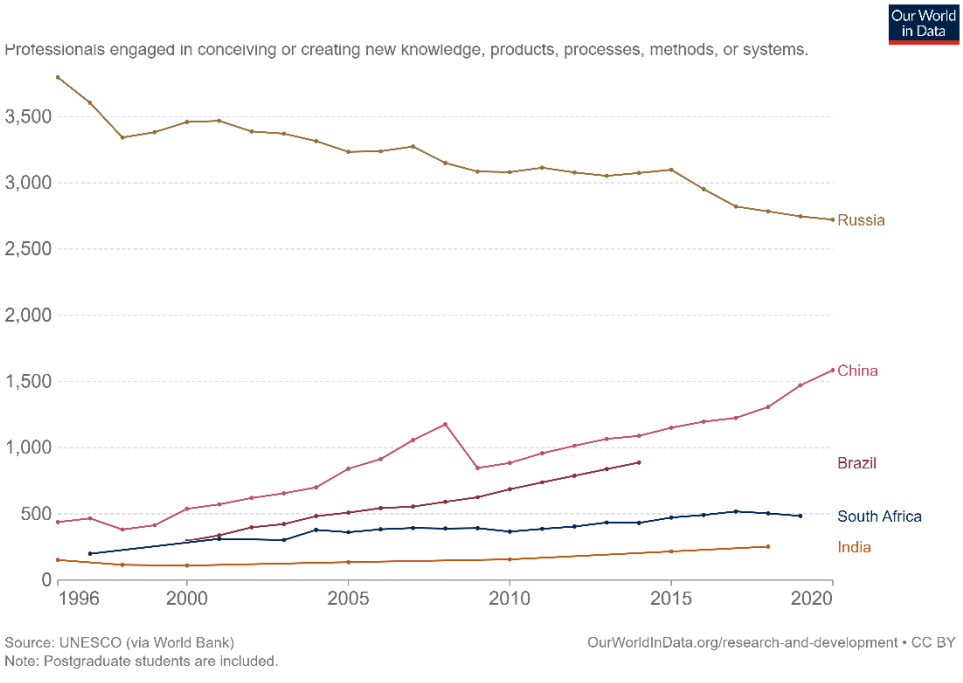


Source: Our world in Data

According to this indicator, countries have the following percentages for 2020: Brazil (2019) – 1,2%, Russia - 1,1%, India – 0,7%, China – 2,4%, South Africa (2018) – 0,7% (Fig.1.).

Another important indicator determining the level of innovative development is the following «Number of R&D researchers per million people». According to this indicator, countries have the following percentages for 2020: Brazil (2014) – 888, Russia - 2722, India (2018) – 253, China – 1585, South Africa (2019) – 484 (Fig.2.).

Fig.2. Number of R&D researchers per million people



Source: Our world in Data

One of the most important indicators of innovation is the number of patent applications. This indicator is divided into two levels - international and domestic (by country) applications. Among the BRICS countries, China (58,990 applications) and India (2,053 applications) are in the top twenty for the international PCT indicator. Since the inception of the PCT system (1978), this is the first time that the US has dropped to second place, passing China, with 57,840 PCT applications. The other countries in the grouping have the following figures: Russian Federation (1,218), Brazil (644) and South Africa (281).

It is also of interest to know how many PCT applications have been filed nationally. According to the WIPO statistical database, for 2019, 60,993 applications were filed in China, 1,247 in Russia, 961 in India, 617 in Brazil, and 80 in South Africa. By comparing two parameters: the number of applications by country of origin and the number of applications filed in a country, it can be concluded whether the inflow of applicants prevails over the outflow of applicants from a country. India and South Africa show the greatest difference between the two indicators, with applicants from these countries mostly not choosing these countries to patent their inventions. To a lesser extent, the same situation is observed in Brazil. In China and Russia, the number of domestic applications received exceeds the number of international applications. The high level of domestic applications shows the confidence of applicants in the countries' patenting policies.[2]

The World Intellectual Property Organization, in addition to researching countries for innovativeness, compiles an annual ranking of the world's largest innovation clusters. The ranking is based on the number of number of patent applications filed in certain countries and regions. Scientific publications are also taken into account on the basis of the Expanded Science Citation Index (Web of Science's Science Citation Index). Clusters are identified on the basis of geographical feature, ranked by the number of PCT applications and the number of scientific publications. In most cases, the cluster is based on a large commercial organization and (or) university that stimulates scientific activity.

The approach to identifying the most dynamic S&T clusters is based on the bottom-up principle, which significantly reduces unnecessary administration by government agencies. The resulting S&T clusters are mostly associated with large urban agglomerations.

Since the BRICS member countries are of interest in this study, the innovation clusters located in Brazil, Russia, India, China and South Africa were studied (data on the number of applications and scientific publications for the period 2014-2020).

In the ranking of the top 100 science and technology clusters in the Global Innovation Index 2022, the majority of BRICS clusters are located in China, there are 18 clusters, 4 in India, and 1 in Russia (Moscow), 1 in Brazil (San Paolo). Innovation clusters from South Africa did not make it to the top-100 clusters ranking.

Chinese clusters experienced the largest increases in S&T output too, with the median increase equating to +13.9 percent and with China hosting the fastest growing clusters – Qingdao (+25.2 percent) and Wuhan (+21.9 percent). Other clusters in middle-income economies,

[2] Patent Cooperation Treaty Yearly Review 2020. Wipo. at: https://www.wipo.int/publications/en/details.jsp?id=4508 (accessed 25 July 2023)

besides those in China, also experienced strong growth, including Chennai (India, +7.1 percent) and Delhi (India, +5.2 percent).

Table 2. BRICS countries in the Global Innovation Index (GII) S&T Clusters (2022)

Position	Name cluster	Country	Number patent applications	Number of scientific publications	Leading patent field, % of applications patent applications by field technologies	Leading organization - patent applicant, % of patent applications from organization
2	Shenzhen–Hong Kong–Guangzhou		72259	118600	Digital Communication, 31,37	Huawei, 23,46
3	Beijing	China	25080	241637	Digital Communication, 21,64	BOE Technology Group, 28,24
6	Shanghai–Suzhou	China	13347	122367	Digital Communication, 21,45	ZTE Corp., 22,66
13	Nanjing	China	1662	84789	Electrical equipment, apparatus, power engineering, 11,09	Southeast University, 9,93
14	Hangzhou	China	4832	48627	Computer technology, 29,88	Alibaba Group, 42,94
16	Wuhan	China	1796	63837	Optic 15,25	Wuhan China Star Optoelectronics Tech., 27,15
22	Xian	China	775	60017	Digital Communication, 15,8	Xi'an Zhongxing New Software, 11,35
29	Chengdu	China	1449	48095	Pharmaceuticals 11,6	Sichuan University, 4,91
31	Moscow	Russia	2060	58153	Computer Technology, 12,28	Yandex Europe, 4,06
34	Qingdao	China	2074	22957	Other goods consumer goods, 43,01	Qingdao Haier Washing Machine, 27,04
37	Tianjin	China	812	812	Computer Technology, 10,47	Tianjin University, 12,48
41	Changsha	China	502	37115	Electrical equipment, apparatus, power engineering, 9,48	Electrical equipment, apparatus, power engineering, 11,09
49	Chongqing	China	689	30023	Optic 16,58	HKC Corp., 36,69

55	Hefei	China	536	29536	Other goods consumer goods, 14,27	Hefei Hualing, 15,29
56	Harbin	China	168	31980	Measurement, 14,32	Harbin Institute of Technology, 36,35
60	Bengaluru	India	3289	17021	Computer Technology, 20,99	Hewlett-Packard, 10,10
61	Jinan	China	511	27956	Computer Technology, 17,85	Shandong University, 18,35
63	Changchun	China	209	29720	Measurement, 15,58	Changchun Institute Of Applied Chemistry, 14,38
64	Delhi	India	855	33570	Pharmaceuticals 12,02	Sun Pharmaceutical Industries, 4,36
68	Shenyang	China	963	22587	Measurement, 11,15	Shandong University, 18,35
71	São Paulo	Brazil	658	18256	Computer Technology, 14,85	São Paulo University
72	Dalian	China	886	19763	Other goods consumer goods, 14,27	Sichuan University, 4,2
83	Zhengzhou	China	1235	16785	Optic 8,5	HKC Corp., 36,2
84	Mumbai	India	1196	18213	Organic Chemistry 17,71	Reliance Industries, 4,3
91	Xiamen	China	687	14328	Electrical equipment, apparatus, power engineering, 5,5	Xiamen University 7,6
97	Chennai	India	1125	17563	Organic Chemistry 10,2	Chennai University, 15,35
100	Lanzhou	China	447	18463	Other goods consumer goods, 8,4	Lanzhou University 10,3

Source: Global Innovation Index (GII), 2020,2022

The successful functioning of innovation clusters is conditioned by effective marketing activities organized within the cluster. In order for BRICS innovation clusters to improve their position in the context of geopolitical instability, a number of measures are proposed to facilitate this:

- innovation clusters and technoparks should be based on higher education institutions - general and specialized - and their activities to train highly qualified personnel, including in research and engineering;

- following the example of India, for successful functioning of the national innovation system, the mandatory participants of which are clusters and technoparks, the implementation of the chain "Universities/Educational Institutions - Enterprises/Businesses/Corporations - State/Executive

and Legislative Bodies - Economy" should be the basis for successful functioning of the national innovation system;

- funding should be both publicly and privately funded (by large corporations);

- obligatory participants to be developed and attracted to clusters and technoparks are laboratories - scientific and research (including those based on universities and TNCs);

- foundations play an important role in supporting clusters and technoparks;

- multidisciplinary and multidisciplinary research, involvement of teams and scientists from different subject areas (humanitarian and applied) in research;

- not the least importance is given to the position of universities in international rankings, citation indicators of scientists and scientific teams, the presence of Nobel laureates and prominent scientists.

- along with product commercialization, an important role in the functioning of innovation clusters and technoparks is played by the creation of entrepreneurial potential, i.e. a close relationship with university graduates, first of all, their inclusion in start-ups, provision of financial support in the form of grants, scholarships, project testing sites

- development of joint educational programs of a practice-oriented format, as well as provision by corporations/companies of platforms for conducting research, testing, novelty confirmation, approbation, "launch/release" with the possibility of further commercialization.

In the new geopolitical realities, it is becoming obvious that the past globalization paradigms no longer have an impact on the livelihoods of the NIS of many countries. Globalization is being replaced by regionalization, the unification of countries based on the proximity of their geopolitical interests. NIS and the process of development of innovation clusters will develop under the influence of the same trends. A possible promising option for further cooperation in the field of technology transfer is cooperation using network platform technologies based on a polycentric model of interaction between national innovation systems and technology transfer centers, the key purpose of which is to conduct joint research and forecasting of the BRICS innovation market, identify opportunities for the formation and internationalization of innovation teams and companies, provide information and recommendations on the placement of new technologies in the BRICS innovation system.

Conclusion

Thus, we can conclude that the regions with the highest concentration of inventors and authors are divided into 2 categories:

Centers of innovation

Specialized innovation clusters.

Innovation centers and clusters account for 85% of all patents and 81% of all scientific activity - that is, more than 80% of all innovation activity in the world. Despite some regionalization processes in the field of innovation, internationally diverse research teams continue to play an important role. Moreover, it is not only the context of their multinationality that is important, but also other qualitative criteria. Despite the processes of regionalization in the field of innovation

networking, the activity of international cooperation is not decreasing, it is just concentrated in a more localized format, pulling internationally dispersed resources to individual regions.

Effective mechanisms of marketing and positioning of BRICS innovation clusters are key to the development of the national innovation system and the promotion of scientific and technological cooperation in the international arena, thus ensuring the economic superiority of the countries. In this regard, the BRICS countries need to create favorable conditions in the changing alignment of global centers of influence to build a system of technology transfer and harmonize norms governing technology ownership rights using a network approach.

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