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Identifying research areas for intensification of intraBRICS collaboration

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Introduction

In recent years research collaboration of BRICS countries in a wide range of subject areas has become a high priority for STI policymakers (see Sokolov et al., 2017). Meanwhile, recent studies in this field confirm that the intensity of intra-BRICS collaboration is quite low (See Khan, 2015; Finardi, 2015; Finardi and Buratti, 2016). Our study following the research of Shashnov and Kotsemir (2018) proposes an approach for detection of research areas with relatively low intensity of collaboration between BRICS countries. We also assess the potential for strengthening of intraBRICS collaboration in research areas with missed opportunities of cooperation between BRICS countries.

Methodology

The analysis is based on key indicators of intraBRICS research collaboration in Scopus in 2000 – 2017. As publications (taken as articles, review and conference papers) in intraBRICS collaboration we define publications whose authors are affiliated with at least two BRICS countries in Scopus. The focus of analysis on subject areas of intraBRICS collaboration is based Scopus classification. To compare intensity of IntraBRICS collaboration versus all international collaboration of BRICS countries we introduce an indicator “index of relative intensity of intraBRICS collaboration” (RIIC index further). This RIIC index is calculated for each BRICS country and for each of 27 Scopus subject areas as the ratio of “Share of subject area in total number of publications produced by country’s authors in international collaboration with authors from other BRICS countries” to “Share of subject area in total number of publications produced in international collaboration (ICPs further) for individual country”. Low (below 0.50) value level of RIIC index means that intensity of intraBRICS collaboration in specific subject area is much lower than the intensity of overall international collaboration of the country’s authors.

Results

The results of our analysis show that BRICS countries are an important player in global science (Figure 1). China is closing the gap with the USA in terms of publication activity level. All BRICS countries (Russia to a somewhat lesser extent) show much higher growth rates of publications in Scopus than the USA, EU28 and entire world.

Country	2000	2017	Growth 2000-2017	2000	2017
	N. of publications			Share in a world	
BRA	14.7	72.0	4.90	1.2%	2.8%
RUS	34.0	85.4	2.52	2.8%	3.3%
IND	24.0	137.1	5.70	2.0%	5.3%
CHI	52.3	513.6	9.81	4.3%	19.9%
SAR	4.9	21.0	4.30	0.40%	0.81%
BRICS	129.2	821.0	6.35	10.7%	31.8%
USA	348.6	566.0	1.62	28.8%	21.9%
EU28	402.4	790.7	1.97	33.2%	30.6%
World	1 210.2	2 582.3	2.13	100%	100%

Figure 1. Basic indicators of publication activity of BRICS countries in Scopus in 2000 and 2017

BRICS countries are not important scientific partners for each other (Figure 2). The share of publications in intraBRICS collaboration in in total number ICPs is less than 5 per cent in China, less than 10% in Brazil and between 10 to 20 per cent in Russia, India and South Africa.

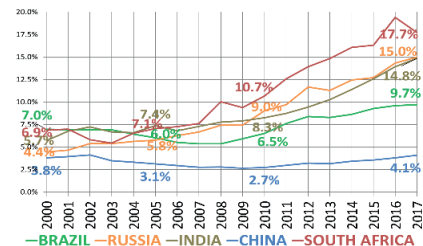


Figure 2. Share of publications in intraBRICS collaboration in the total number of ICPs of BRICS countries in Scopus

Nearly one third of intraBRICS collaboration is concentrated in “Physics and Astronomy” research area (Figure 3). The other important areas of

IntraBRICS research collaboration are “Materials science”, “Medicine” and “Engineering”. In social sciences and humanities, the level of intraBRICS collaboration is very low.

Subject Area	IntraBRICS collaboration					
	Number of publications			Share in intraBRICS collaboration		
	2000	2010	2017	2000	2010	2017
AGRI	38	243	685	6.0%	11.4%	9.7%
ARTS	2	8	39	0.3%	0.4%	0.6%
BIOC	36	228	658	5.7%	10.7%	9.3%
BUSI	1	7	74	0.2%	0.3%	1.0%
CENG	17	81	429	2.7%	3.8%	6.1%
CHEM	45	219	797	7.1%	10.3%	11.3%
COMP	24	119	605	3.8%	5.6%	8.6%
DECI	4	12	70	0.6%	0.6%	1.0%
DENT	0	12	25	0.0%	0.6%	0.4%
EART	82	236	674	13.0%	11.1%	9.5%
ECON	2	8	51	0.3%	0.4%	0.7%
ENER	18	51	284	2.9%	2.4%	4.0%
ENGI	117	281	1,211	18.6%	13.2%	17.2%
ENVI	17	98	497	2.7%	4.6%	7.0%
HEAL	1	5	49	0.2%	0.2%	0.7%
IMMU	18	74	189	2.9%	3.5%	2.7%
MATE	85	274	1,130	13.5%	12.8%	16.0%
MATH	47	193	612	7.5%	9.0%	8.7%
MEDI	38	294	993	6.0%	13.8%	14.1%
MULT	8	29	195	1.3%	1.4%	2.8%
NEUR	1	19	93	0.2%	0.9%	1.3%
NURS	1	16	35	0.2%	0.7%	0.5%
PHAR	7	37	184	1.1%	1.7%	2.6%
PHYS	354	823	2,186	56.2%	38.3%	31.0%
PSYC	0	15	55	0.0%	0.7%	0.8%
SOCI	5	41	215	0.8%	1.9%	3.0%
VETE	0	6	23	0.0%	0.3%	0.3%
Total	630	2,135	7,061	100%	100%	100%

Note: see full list and abbreviated titles of 27 Scopus subject areas at: <https://dev.elsevier.com/tips/ScopusSearchTips.htm>

Figure 3. Basic indicators of IntraBRICS scientific collaboration in Scopus

Figure 4 shows the values of RIIC index for BRICS countries. Areas with highest relative intensity of intraBRICS collaboration are “Physics and astronomy” and “Earth and planetary science”. Social sciences and humanities show the lowest value of the Index. In general, low level of Index is recorded for “Computer science”; “Decision sciences”, “Health professions” and “Psychology”.

Subj. Area	BRA	RUS	IND	CHI	SAR
AGRI	0.55	1.00	1.05	1.15	0.77
ARTS	0.38	0.26	0.61	0.61	0.20
BIOC	0.72	0.82	0.81	0.66	0.89
BUSI	0.59	0.41	0.64	0.47	0.47
CENG	0.66	0.92	0.82	0.55	1.52
CHEM	0.73	0.80	0.82	0.77	1.46
COMP	0.52	0.61	0.64	0.41	0.81
DECI	0.37	0.61	0.62	0.50	0.77
DENT	0.34	1.32	0.41	1.79	3.02
EART	1.49	1.16	1.54	1.30	1.31
ECON	0.60	0.27	0.57	0.46	0.40
ENER	0.66	0.74	0.77	0.56	0.99
ENGI	0.93	0.86	0.81	0.58	1.34
ENVI	0.62	0.89	1.00	0.73	0.70
HEAL	0.44	0.67	0.79	0.72	0.46
IMMU	0.77	0.92	0.88	0.96	0.90
MATE	0.97	0.73	0.90	0.76	1.34
MATH	0.94	0.69	0.83	0.90	1.13
MEDI	0.92	1.08	1.04	0.94	0.82
MULT	1.38	1.07	1.10	0.80	0.94
NEUR	0.56	0.71	0.85	0.55	0.66
NURS	0.61	0.77	1.14	0.87	0.59
PHAR	0.68	0.69	0.73	0.68	1.07
PHYS	2.51	1.21	1.55	2.36	1.91
PSYC	0.76	0.71	0.78	0.63	0.36
SOCI	0.51	0.50	0.66	0.58	0.29
VETE	0.30	1.11	1.09	1.51	0.58

Figure 4. Values of RIIC index for BRICS countries in Scopus subject areas for 2013 -2017

Considering dynamics, structure and concentration of country-partners of BRICS countries as well as positions of country-partners in global science for subject areas with low values of RIIC index we assess the potential for intensification of intraBRICS collaboration in these areas. Table 1

shows an example of such an assessment for research areas where values of RIIC index is below 0.50 for at least two BRICS countries. The results show that high potential for intensification of intraBRICS collaboration exists in ‘Business, management and accounting’, ‘Health professions’ and ‘Social sciences’ areas, while for ‘Arts and humanities’ and ‘Dentistry’ this potential is low.

Table 1. Example of schematic assessment of potential for intensification of intraBRICS collaboration

Subj. area	BRA	RUS	IND	CHI	SAR
ARTS	Medium	Weak	N/A	N/A	Medium
BUSI	N/A	Medium	N/A	Strong	Strong
DECI	Weak	N/A	N/A	Strong	N/A
DENT	Medium	N/A	N/A	N/A	Weak
ECON	N/A	Weak	N/A	Strong	Medium
HEAL	Strong	N/A	N/A	N/A	Strong
SOCI	Strong	Strong	N/A	N/A	Strong

Note: N/A means “not assessed”. We do not assess potential for intensification of intraBRICS collaboration for cells where RIIC index is higher than 0.50.

Conclusions

This study provided an overview of intraBRICS research collaboration and proposed an approach for detection of research areas with relatively low intensity of collaboration between BRICS countries. We also estimated the opportunities for strengthening of intraBRICS collaboration across research areas. Further analysis of potential for intensification of intraBRICS collaboration in areas with very low values of RIIC index collaboration is needed at the level of individual organisations. Here one should take into an account the level of concentration of leading organisations in selected research areas, the structure of their collaboration network and the place of partners from BRICS in these networks (see Moed et al., 2011 proposing an analysis with similar approach).

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