

Bibliometric analysis of the most cited articles in BRICS research

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Abstract

Bibliometric analysis identifies the most impactful and prolific journals, authors, countries, and institutions by assessing the most cited articles in a specific research area. The aim of this study is to analyze and to provide a scope of modern scientific products related to BRICS. The 100 most cited articles related to the BRICS research were retrieved from the study “(BRICS)” in the Scopus database. The variables collected and included in this analysis are: number of citations, article title, first author’s name, year and journal of publication and its impact factor, theme and country mentioned in the database at the time of publication, and category of the paper (original article or review).

Keywords: BRICS, bibliometric analysis, impact factor.

JEL: Z00.

Introduction

BRICS is a group formed by five developing countries — Brazil, Russia, India, China, and South Africa. Together they make up 42% of the world’s population and contribute to 23% of the world’s gross domestic product. It was designed in 2001 and launched in 2006 (Mielniczuk, 2013; Gammeltoft, 2008).

Although all BRICS member countries provide significant contribution to all fields of science and encourage research, to the best of the authors’ knowledge, the academic impact of research concerning the aspects related to BRICS itself was never assessed. Brazil, Russia, India and China have been promoting their consolidation as a political

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group since 2006. The citation rate of articles can be used to estimate the impact of a given research in a specific field. Moreover, many metrics of individual authors and journals depend on the number of citations. Examples include a journal's impact factor (IF), Scimago journal rank, and others. Assessing the most cited articles in a specific research area is important in terms of determining the most active journals, authors, countries, institutions, and specialties, covering the scope of the research field in question (Noyons et al., 1999; Garner et al., 2017).

This paper aims to evaluate the impact of the available research in this field, as well as scrutinize tendencies related to the presented variables.

1. Methodology

1.1. Search protocol

The 100 most cited articles in BRICS research were identified through an analysis in Elsevier's Scopus in September 2020. The string we searched for was "(BRICS)." The articles were arranged from a higher to a lower number of citation, and the 100 most cited were exported and analyzed. No other restrictions were adopted. The 2019 IF and the 5-year IF of the most cited journals were retrieved from the InCites Journal Citation Reports (JCR) website (<https://jcr.incites.thomsonreuters.com/>) in October 2020.

1.2. Bibliometric analysis

From the 100 most cited papers, the following variables were collected and included in this analysis: number of citations, article title, first author's name, year and journal of publication and its IF, category of the article, and issue of the paper. We obtained the average number of citation out of the 100 most cited papers using Microsoft Excel. We classified the articles into primary research and secondary research.

2. Results

2.1. Overview

Our search resulted in 2326 articles in the Scopus database. The average number of citations was 62.48, ranging from 37 to 209. The ten most cited publications ranged from 103 to 209 citations (average = 138.3). The most cited article was a literature review published in 2014 in the journal named *Renewable and Sustainable Energy Reviews* by Sebri et al., Egypt, which had 209 citations. When analyzing only original articles, the average number of citations was 60.73, ranging from 37 to 174. The most cited paper

among the original articles was published by W. N. Cowan et al. in *Energy Policy* in 2014, it accounts for 174 citations. As for review articles, the greatest number of citations was from W. Mensi, who was also the first in the overall analysis — 234 citations. The complete list is provided in Appendix (Table 1.1).

2.2. Journal and IF analysis

In total, 64 different journals were represented when publishing the 100 most cited articles. The list with the number of articles in the top 100, the number of citations and IF for the ten most cited journals is provided in Appendix (Table 1.2). Among the 100 most cited articles, 43 were from the ten most cited journals, accounting for 2,697 of the total 6,258 citations. *Third World Quarterly* and *International Review of Financial Analysis* were the journals with the highest numbers of articles, both with 6 articles in the top 100. However, regarding the number of citations, *Third World Quarterly* led with 423 citations. There were 6 journals with no impact factor (*International Journal of Business Science and Applied Management*; *International Journal of Technology and Globalization*; *Strategic Narratives: Communication Power and the New World Order*; *Global Finance Journal*; *World Patent Information*; and *American Foreign Policy Interests*). The IF was not used for reports presented at conferences, in books, etc.

2.3. Country analysis

The 100 most cited papers were published by institutions from 27 different countries. By far, China was the country with the most published documents, with 22 papers out of the top 100 and the most cited — 1,286 citations. After excluding secondary research, China remained the most prolific (20 articles in the top 100), as well as the most cited country (1,200 citations). The second country in terms of the number of articles was the United Kingdom (14 articles), as well as in the number of citations (828). For the complete list of the publications and citations by country, see Table 1.

Table 1. Number of documents and citations by country

Country	Number of publications	Total number of citations
China	22	1286
United Kingdom	14	828
United States	9	479
South Africa	5	365
Germany	5	281
Greece	3	269
Canada	4	243
Vietnam	2	234

Table 1. Continued

Country	Number of publications	Total number of citations
Pakistan	4	233
Egypt	1	209
Denmark	3	203
Italy	4	202
Netherlands	2	176
India	2	135
Brazil	3	129
Tunisia	2	120
Turkey	2	119
Spain	2	118
France	2	103
Finland	2	100
Belgium	1	95
Puerto Rico	1	65
Singapore	1	60
Portugal	1	53
Saudi Arabia	1	52
Serbia	1	50
Malaysia	1	41

2.4. Year analysis

Articles were published from 2006 to 2020, and, with the exception of 2009, these publications occurred every year. 2013 encompassed the largest number of citations (1218) and articles (20) in the top 100. The second largest number of published papers was in 2016 (15 papers), and the second largest number of citations was in 2014 (1,121). See Table 2, 3 and Figure 1.

Table 2. Documents and citations by year of publication

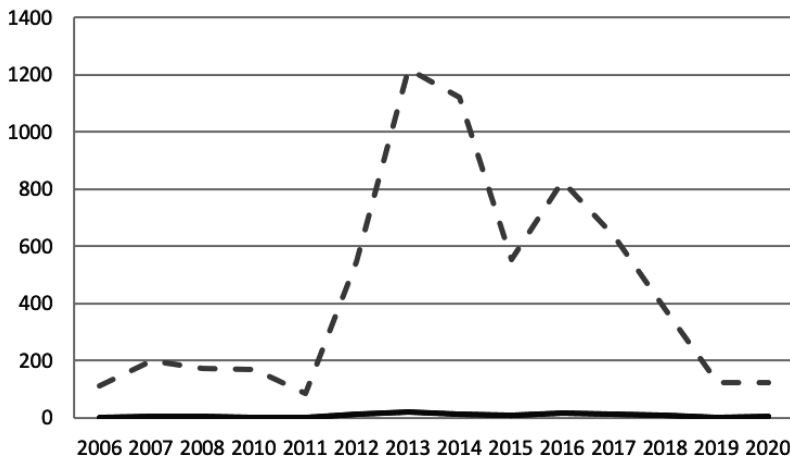
Year	Number of citations	Number of articles
2006	110	2
2007	197	3
2008	172	3
2010	169	2
2011	84	2
2012	546	10

Table 2. Continued

Year	Number of citations	Number of articles
2013	1218	20
2014	1121	11
2015	553	8
2016	828	15
2017	631	12
2018	376	7
2019	121	2
2020	122	3

Table 3. Type of publication by number of documents

Type of publication	Number of publications	Total number of citations
Article	90	5466
Book	1	60
Conference paper	2	93
Note	1	135
Review	6	494

**Figure 1.** Documents and citations by year of publication. The continuous line indicates the number of publications in the top 100, and the dotted line — the number of citations

2.5. First author and article category analysis

The first author with the highest number of citations and articles in the top 100 was W. Mensi (2 articles and 234 citations). 5 most prolific authors were published, each one

with 2 documents — Z. Wang, W. Chkili, Q. Ji, C. Ban, and W. Mensi. The h-index among the ten most cited first authors varied from 1 (W. N. Cowan) to 34 (M.-L. Song). For the complete list, see Appendix (Table 1.1).

3. Discussion

3.1. Findings

Bibliometric analysis is useful for assessing the most active journals, authors, countries, institutions, and specialties in a particular field of research. In our case, studies of this kind can be performed to evaluate the scientific output of our countries in terms of their socio-economic development.

The findings of this bibliometric analysis show that China provides a large amount of impactful publications related to BRICS and is the most prolific country in this regard. Therefore, China comprises the largest number of publications in the top cited BRICS research and, as mentioned above, the highest number of publications overall. Next in the list among the BRICS members with the highest number of citations is South Africa (365 citations and 5 papers), India (135 citations and 2 papers), and Brazil (129 citations and 3 papers), respectively. Russia is not listed in the rank. Although the total number of publications with significant repercussions, if measured by the number of citations, by BRICS members represents just 30.65% of the rank.

The term “impact factor” designates statistics commonly used as an indirect indicator of the quality of research. It is calculated using the total number of citations of articles (numerator) and the total number of published articles (denominator) in a particular journal over a certain period of time. There is also another available form of the IF that is derived from the last five years (5-Year IF), which is usually more stable than the first one (Dong et al., 2005). In this study, we present a bibliometric analysis of the impact factor of journals that published the most cited articles on the topic of BRICS. Our findings show that the largest number of publications out of the top 100 were published in less than 10 journals. But only 3 of them were published in journals with an impact factor higher than 10 (*The Lancet*, *Nature Climate Change*, and *Renewable and Sustainable Energy Reviews*).

In addition, this pattern varies in the total number of citations on all subjects, as shown in the Scimago Journal & Country Rank (<https://www.scimagojr.com/countryrank.php>). According to that ranking, China is the 2nd most cited country, followed by India (9th), Russia (12th), Brazil (15th), and South Africa (34th), respectively.

As expected, we demonstrate that the majority of the most cited articles in this field were published after 2013 (78 out of 100 articles), which accounts for 4970 out of the total number of citations from the 100 most cited papers, showing the highest number of papers published in 2013 (20% out of 100 articles). However, after 2013, the number of articles and citations decreased over time, reaching another, but lower maximum in 2016. But after that, their number decreased significantly and constantly. The initial metric for a particular author is his or her number of citations. However, an author may have a high

citation number with only a few papers, without being cited in many other articles. The h-index, in turn, is a metric that combines both the author's number of publications and the number of citations, considering, theoretically, the quantity and quality of research performed by the author. Among the ten most cited authors in the BRICS research, two authors had an h-index higher than 30: M.-L. Song = 34; S. M. Borrás Jr. = 33.

3.2. Strengths and limitations

In this study, we assessed information regarding the 100 most cited articles in the BRICS research. These include the number of citations, first author's name, year and journal of publication, country and affiliation of the corresponding author at the time of publication, and category of paper (review or original article). For each variable, we evaluated the number of documents in the top 100, as well as the number of citations. However, this study has some limitations. Since the information was retrieved from a single database (Scopus), some articles may have been omitted and the number of citations underestimated — although the authors believe that this is unlikely to occur. Indeed, Scopus covers more than 36,000 journals (data retrieved from <https://www.scopus.com/sources>), including Medline and Embase-indexed journals. This is a significantly broader coverage than the approximately 21,000 journals covered by the Web of Science Core Collection (WoS), for instance (data retrieved from <https://clarivate.libguides.com/webofscienceplatform/coverage>). In addition to that, Scopus found approximately 93% of the citations by WoS. Despite having more sources than Google Scholar, between 48% and 65% of the citations found by Google Scholar alone were from a non-journal source. In addition, documents submitted by Google Scholar had a less scientific impact and were less cited than sources that were also present in Scopus or WoS, which suggests that Google Scholar's greater reach is mainly related to low-impact sources. These facts led the authors to choose the Scopus database (Martín-Martín et al., 2019).

Moreover, when evaluating the number of citations by the year of publication, the authors found out that more recent papers contained a fewer number of publications. Probably, this occurs because these papers will be cited in the following years. Another limitation is that some authors may belong to multiple affiliations, which may contribute to both overestimating and underestimating these variables.

Conclusions

We conduct a bibliometric analysis to assess the impact of BRICS-related research in the literature to date (October 2020). Our analysis shows that the research in this field has recently become much more active and touches on various issues. China is, by far, the most impactful country in the world regarding the research in this area. Of the BRICS countries, only South Africa and China are among the 10 most cited publications. Further research in this specific field is encouraged, mainly in the BRICS countries themselves, as they have particular insights and perspectives on their own reality and, consequently, can more accurately indicate the main problems to be analyzed.

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Appendix

Table 1.1. Number of documents and citations by author

Author's name	Number of publications	Total number of citation
Mensi, W.	2	234
Ban, C.	2	137
Chkili, W.	2	120
Wang, Z.	2	104
Ji, Q.	2	93
Sebri, M.	1	209
Cowan, W. N.	1	174
Dimitriou, D.	1	156
Marten, R.	1	135
Borras Jr.	1	113
Armijo, L. E.	1	108
Babb, S.	1	107
Dong, K.	1	105
Song, M.-L.	1	103
Raza, N. M.	1	97
Vijayakumar, N.	1	96
Böhm, S.	1	95
Fallon, T.	1	95
Wu, L.	1	95

Table 1.1. Continued

Author's name	Number of publications	Total number of citation
Stephen, M. D.	1	88
Wang, Y.	1	83
Bekiros, S. D.	1	79
Ozturk, I.	1	75
Glosny, M. A.	1	73
Haseeb, A.	1	72
MacFarlane, S. N.	1	70
Baloch, M. A.	1	66
Gammeltoft, P.	1	66
Paul, J.	1	65
de Vries, G. J.	1	63
Degen, J.	1	63
Fungáčová, Z.	1	63
Hopewell, K.	1	63
Farzad, S.	1	62
Reboredo, J. C.	1	61
Miskimmon, A.	1	60
Sidaway, J. D.	1	60
Shen, L.	1	58
Syriopoulos, T.	1	58
Chang, M.-C.	1	57
Corbera, E.	1	57
Pretty, J.	1	57
Ardichvili, A.	1	56
Kenourgios, D.	1	55
Cox, M.	1	54
Laidi, Z.	1	54
Shahbaz, M.	1	54
Gomes, S.	1	53
Latif, Z.	1	53
Nassani, A. A.	1	52
Cooper, A. F.	1	50
Jakovljevic, M.	1	50
Boubaker, H.	1	49
Camioto, F. D. C.	1	49
Swilling, M.	1	49

Table 1.1. Continued

Author's name	Number of publications	Total number of citation
Zeng, S.	1	49
Cheng, H. F.	1	48
Bornmann, L.	1	47
Ferchen, M.	1	47
Liu, X.	1	47
Alden, C.	1	45
Azevedo, V. G.	1	45
Klochikhin, E. A.	1	45
Öniş, Z.	1	44
Rizzi, F.	1	44
Zhang, B.	1	44
Zhang, C.	1	44
Thomas, V. J.	1	43
Yu, P. K.	1	43
Adedoyin, F. F.	1	42
Bond, P.	1	42
Chin, G. T.	1	42
Lebaron, G.	1	42
McCarthy, D. J.	1	42
Sui, L.	1	42
Zaman, K.	1	42
Filippetti, A.	1	41
Gray, K.	1	41
Haseeb, M.	1	41
Sotero, P.	1	41
Ulucak, R.	1	41
Ahmed, K.	1	40
Cooper, J.	1	40
Garcia, A. S.	1	40
Mielniczuk, F.	1	40
Xu, H.	1	40
Mallick, S. K.	1	39
Pant, H.V.	1	39
Balcilar, M.	1	38
Bekiros, S.	1	38
Hammoudeh, S.	1	38

Table 1.1. Continued

Author's name	Number of publications	Total number of citation
Schirm, S. A.	1	38
Lehkonen, H.	1	37
Wagner, C. S.	1	37
Zhang, J.	1	37

Table 1.2. IF and 5-year IF by journal

Journal	2019 IF	5-year-IF
<i>American Foreign Policy Interests</i>	N/a	N/a
<i>American Journal of Law and Medicine</i>	0.925	0.991
<i>Applied Energy</i>	8.848	9.086
<i>Asia Pacific Business Review</i>	0.949	1.213
<i>Asian Perspective</i>	0.549	0.802
<i>Biotechnology for Biofuels</i>	5.452	6.343
<i>ChemMedChem</i>	3.124	3.113
<i>China Economic Review</i>	2.736	3.372
<i>Economic Modelling</i>	1.930	2.362
<i>Economic Systems</i>	1.578	2.028
<i>Emerging Markets Review</i>	3.092	3.282
<i>Energy</i>	6.082	6.046
<i>Energy Economics</i>	5.203	5.790
<i>Energy Policy</i>	5.042	5.693
<i>Environmental and Resource Economics</i>	2.286	2.490
<i>Environmental Progress and Sustainable Energy</i>	1.989	1.928
<i>Environmental Science and Pollution Research</i>	3.056	3.306
<i>Eurasian Geography and Economics</i>	1.193	1.898
<i>European Journal of International Relations</i>	3.474	3.925
<i>Global Finance Journal</i>	N/a	N/a
<i>Global Policy</i>	1.238	1.266
<i>Globalizations</i>	1.614	1.668
<i>Habitat International</i>	4.310	4.447
<i>Health Economics (United Kingdom)</i>	2.250	2.666
<i>International Affairs</i>	3.705	3.268
<i>International Journal of Business Science and Applied Management</i>	N/a	N/a
<i>International Journal of Technology and Globalisation</i>	N/a	N/a
<i>International Politics</i>	0.619	0.799
<i>International Relations</i>	1.250	1.446

Table 1.2. Continued

Journal	2019 IF	5-year-IF
<i>International Review of Economics and Finance</i>	1.818	2.119
<i>International Review of Financial Analysis</i>	2.497	2.761
<i>Journal of Asian Economics</i>	1.797	N/a
<i>Journal of Business Ethics</i>	4.141	5.455
<i>Journal of Cleaner Production</i>	7.246	7.491
<i>Journal of Comparative Economics</i>	1.992	2.473
<i>Journal of Empirical Finance</i>	1.566	1.891
<i>Journal of Environmental Policy and Planning</i>	3.040	3.313
<i>Journal of International Money and Finance</i>	2.014	2.790
<i>Journal of the Association for Information Science and Technology</i>	2.410	3.166
<i>Mathematics and Computers in Simulation</i>	1.620	1.638
<i>Nature Climate Change</i>	20.893	24.312
<i>North American Journal of Economics and Finance</i>	1.535	1.756
<i>Open Economies Review</i>	1.035	1.165
<i>Organization Studies</i>	3.941	5.410
<i>Polity</i>	N/a	N/a
<i>Professional Geographer</i>	1.623	2.183
<i>Public Health Nutrition</i>	3.182	3.341
<i>Renewable and Sustainable Energy Reviews</i>	12.110	12.348
<i>Renewable Energy</i>	6.274	5.964
<i>Research in International Business and Finance</i>	1.801	N/a
<i>Research Policy</i>	5.351	7.929
<i>Resources Policy</i>	3.986	4.332
<i>Review of International Political Economy</i>	2.312	3.909
<i>Review of International Studies</i>	1.944	2.326
<i>Science of the Total Environment</i>	6.551	6.419
<i>Scientometrics</i>	2.867	3.073
<i>Strategic Narratives: Communication Power and the New World Order</i>	N/a	N/a
<i>Sustainable Cities and Society</i>	5.268	5.143
<i>Telematics and Informatics</i>	4.139	4.454
<i>The Lancet</i>	60.392	59.345
<i>Third World Quarterly</i>	1.930	2.362
<i>Washington Quarterly</i>	1.288	1.212
<i>World Development</i>	3.869	4.749
<i>World Patent Information</i>	N/a	N/a