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Original article

Bibliometric analysis of mentions of the BRICS block in the context of scientific research in 2015-2024 based on metadata of the DIMENSIONS platform

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Abstract

At the current stage of global economic development, international relations are experiencing turbulence due to geopolitical shifts in Europe and Southwest Asia. In this context, BRICS is emerging as a leading force among global economic blocs. A review of articles on BRICS published between 2015 and 2024 in journals indexed on the DIMENSIONS platform revealed a gap in research that systematically analyzes trends and identifies patterns in this field. The number of publications has shown a linear increase over the years, with a significant surge in studies focused on geopolitics and political science after mid-2022. Bibliometric analysis of this topic has led to several key observations, which are presented below. Key bibliographic elements are fully recorded, ensuring excellent data quality. The most critical deficiencies are found in Cited References, Language, and Science Categories. The most significant cluster of terms connected to the analysis is concentrated on sustainable development. The second cluster highlight the geographical and environmental dimensions of the field with focus on the impact of human activity and climate change in terms of rapidly developing economies of the bloc countries in question. The scientific research articles are provided by China, India, Pakistan, South Africa, and Turkey where China (marked as the most cited country and as the central hub in the scientific collaboration network) and India (marked as the second most cited country) perform the most fruitful scientific collaboration in the terms of research the BRICS bloc. A significant part of the research is aimed at solving problems and development in the field of ecology and finding solutions to environmental pollution problems.

Keywords: bibliometric analysis, BRICS, BRICS+, China, Dimensions scientific research database, India, network hub, Russia, scientific journal, scientific publication

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Оригинальная научная статья

Библиометрический анализ упоминаний блока БРИКС в контексте научных исследований 2015-2024 гг. на основе метаданных платформы DIMENSIONS

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Аннотация

На текущем этапе развития мировой экономики международные отношения переживают турбулентность из-за геополитических сдвигов в Европе и Юго-Западной Азии. В этом контексте ведущей силой среди глобальных экономических блоков становится БРИКС. Обзор статей по БРИКС, опубликованных в период с 2015 по 2024 гг. в журналах, индексируемых на платформе DIMENSIONS, выявил пробел в исследованиях, которые систематически анализируют тенденции и выявляют за-

кономерности в этой области. Количество публикаций показывает линейный рост с годами, при этом значительный всплеск исследований, посвященных геополитике и политологии, произошел после середины 2022 года. Библиометрический анализ этой темы привел к нескольким ключевым наблюдениям, которые представлены ниже. Ключевые библиографические элементы полностью зафиксированы, что обеспечивает превосходное качество данных. Наиболее существенные недостатки обнаружены в категориях «Цитируемые ссылки», «Язык» и «Наука». Наиболее значимый кластер терминов, рассматриваемых в анализе, связан с устойчивым развитием. Второй кластер включает географические и экологические аспекты области с акцентом на воздействие человеческой деятельности и изменения климата с точки зрения быстро развивающихся экономик стран блока. Научно-исследовательские статьи предоставлены Китаем, Индией, Пакистаном, Южной Африкой и Турцией, где Китай (отмечен как наиболее цитируемая страна и как центральный узел в сети научного сотрудничества) и Индия (отмечена как вторая наиболее цитируемая страна) осуществляют наиболее плодотворное научное сотрудничество с точки зрения исследований блока БРИКС. Значительная часть исследований направлена на решение проблем и разработок в области экологии и поиск решений проблем загрязнения окружающей среды.

Ключевые слова: библиометрический анализ, БРИКС, БРИКС+, Китай, база данных научных исследований Dimensions, Индия, сетевой концентратор, Россия, научный журнал, научная публикация

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Introduction

Since its inception in 2006, BRICS has demonstrated that shared borders do not necessarily guarantee productive cooperation [1]. Contemporary deglobalization trends are increasingly intersecting with the rise of digital globalization, which operates independently of geographic proximity [2]. Since 2014, globalization has undergone a reversal, marked by disintegration processes in both the Global West [3] and Eurasia [4].

Over the past eighteen years, BRICS (initially BRIC, now BRICS+)–formed through an agreement between Brazil, Russia, India, and China–has disproved early skepticism regarding the organization's viability. Critics initially dismissed BRICS as a formal alliance, citing factors such as geographical dispersion (except for the shared borders between Russia and China, as well as China and India), vast cultural differences, historical tensions – particularly territorial disputes between India and China – economic heterogeneity, the absence of a unified global agenda, differing interpretations of democracy, linguistic barriers, and disparities in GDP structure. However, in the last decade, BRICS has solidified its role on the international stage, attracting increasing attention from researchers. The patriarchal component comes to the forefront with a leader who concentrates power as the father or patriarch of the people, which makes the world community wonder whether there are prospects for a liberal future in a non-hegemonic worldю [5]

The relevance of this study is underscored by global shifts in the international economy, the growing influence of BRICS countries as economic power centers, and the bloc's expansion through new membership statuses and affiliations. BRICS is increasingly seen as an alternative to the collective West, reflecting the dynamics of a multipolar world [6]. It is also characterized as a coalition guided by a paternalistic approach and as an alliance capable of effective collaboration despite cultural differences. Additionally, the concept of the "Big Three BRICS" – referring to Russia, India, and, particularly, China–is gaining prominence. [7, 8]

This bibliometric analysis is based on scholarly works from the Dimensions database, authored by both theorists and practitioners used in various fields [9], [10]. Notably, many co-

authored publications involve researchers from outside BRICS, highlighting the bloc's broad academic engagement. Given the ongoing evolution of BRICS cooperation, this study remains dynamic and open-ended. The findings emphasize the observational nature of existing research while underscoring the need for further investigation. A more detailed analysis could refine terminology within BRICS relations, identify emerging trends, and enhance strategic planning for future collaborations.

The research methodology is centered on bibliometric analysis, allowing for the identification of emerging trends, recurrent terminology, and associative frameworks related to BRICS within the context of deglobalization. This approach aligns with the principles of sustainable development and offers insights into the evolving role of BRICS in the global landscape.

Context and debates

The BRICS group–comprising Brazil, Russia, India, China, and South Africa–has garnered significant attention from experts across various disciplines, particularly in economics, international relations, and political science. Since its formation in 2006 as BRIC and its subsequent expansion into the BRICS+ format, the bloc has strengthened its role in global affairs, contributing to the emergence of a multipolar world. Notably, Western sanctions imposed on Russia since 2014 have failed to achieve the intended isolating effect, largely due to economic collaborations within BRICS. The structure of trade, particularly between India and Russia, has evolved dynamically over this period. [11]

A key paradox for researchers is the ability of BRICS nations to engage in diplomatic negotiations and international cooperation despite their significant differences and global ambitions. This is reflected in the bibliometric analysis of BRICS-related research.

One defining characteristic of the bloc is its deliberate rejection of a common cultural framework or the standardization of economic and social indicators. This approach aligns with the principle of sustainable development, which emphasizes preserving national diversity rather than imposing a new form of universality. However, certain key factors have facilitated long-term and productive cooperation among member states.

One of the most significant is the paternalistic approach adopted by BRICS nations in foreign policy. Each country prioritizes its national interests while maintaining cooperative relations with neighbors and partners. Within the bloc, the most influential members–India, China, and Russia–play a leading role in shaping its strategic direction, a dynamic influenced not only by current deglobalization trends but also by the historical and cultural backgrounds of these nations.

With their substantial economic power, large populations, and high GDPs, India, Russia, and China often set the agenda for BRICS economic cooperation. Their leadership is evident in initiatives such as the establishment of the New Development Bank (NDB) and the Contingent Reserve Arrangement (CRA). While smaller BRICS members participate in these initiatives, they may not always have equal influence over strategic decision-making. Nonetheless, their interest in BRICS is largely driven by the economic benefits gained through the patronage of the Big Three.

Following the full-scale Russian special military operation in Ukraine on February 24, 2022, and the intensification of geopolitical tensions, BRICS has increasingly been perceived as a counterweight to NATO. However, it is crucial to distinguish BRICS from an outright opposition to Western-dominated institutions like the International Monetary Fund (IMF) and the World Bank. Rather than challenging these institutions directly, BRICS offers an alternative economic alliance focused on financial cooperation and development.

Several economic initiatives highlight BRICS' role as an alternative to Western financial systems:

New Development Bank (NDB): Established to fund infrastructure projects in developing nations, particularly in the Global South, the NDB serves as an alternative to the World Bank and IMF, institutions traditionally dominated by Western powers. The bank aims to reduce dependency on Western financial systems. For example, despite sanctions that cut Russia off from global payment networks such as Visa, MasterCard, American Express, and JCB, China's UnionPay continued cooperation with Russia's national payment system, MIR. Additionally, discussions about integrating India's RuPay with MIR have been ongoing since August 2022. While the idea of a single BRICS currency has been raised, it is not currently a priority; instead, BRICS countries continue to conduct transactions in their national currencies as part of a broader de-dollarization strategy.

Contingent Reserve Arrangement (CRA): This initiative provides financial stability to BRICS members by offering emergency liquidity to countries facing short-term balance-of-payments difficulties, thus reducing reliance on IMF loans, which often come with strict conditions.

This study aims to trace the chronological development of BRICS-related research, identifying key trends and shifts in focus over time. It seeks to highlight the most cited authors and journals, as well as to map out collaborative networks among researchers and institutions. Additionally, the study will analyze emerging research topics within BRICS scholarship, using trend analysis, factor analysis, and keyword citation bursts to identify new directions in the field. Finally, it will highlight underexplored areas and gaps in the literature, providing a foundation for future research to advance the field.

Methodology

For this bibliometric analysis study, a structured methodology was implemented following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a widely recognized approach for ensuring transparency and comprehensiveness in systematic reviews and meta-analyses [12]. This methodology consists of four key stages: identification, screening, eligibility, and inclusion. When applied to bibliometric analysis, PRISMA facilitates the systematic selection of relevant literature, ensuring a rigorous and reproducible research process. The literature selection process is visually represented using a PRISMA flow diagram.

The identification stage began with the formulation of a precise search query designed to capture all relevant literature on BRICS. The search string used in the Dimensions database included TS = ("BRICS", "BRICS bloc", and "BRICS in the current economic scenario"), ensuring comprehensive coverage of relevant studies. This search was conducted in the first week of January 2025, providing access to the most recent data available. The search yielded a total of 433 documents published between 2015 and 2024 across various countries, contributing to the global research discourse on BRICS.

During the manual screening phase, duplicate records were identified and removed. Additionally, articles unrelated to the subject, such as those from biological sciences, as well as non-English publications, were excluded. After this refinement, all 433 documents were deemed relevant for inclusion in the study.

The next phase involved data extraction and analysis. The retrieved data were imported into RStudio, where the "bibliometrix" package was utilized to perform bibliometric analysis. This package provides a comprehensive suite of analytical tools, enabling diverse analyses such as co-occurrence analysis and citation analysis across multiple dimensions, including authors, journals, and countries.

Through this process, visualization maps were generated, illustrating relationships and emerging trends within BRICS-related research. These visual representations highlighted collaboration networks, influential authors, and the geographic distribution of research activity.

This structured and robust approach allowed for a clear and systematic examination of the evolution and impact of BRICS research, enhancing understanding through graphical insights.

Result and Discussion

To assess the quality and completeness of metadata in our dataset, we conducted an analysis of missing values across various metadata fields. The findings reveal a mixed level of completeness, with some fields being well-documented while others exhibit significant data gaps.

Key bibliographic elements, including Document Type, Publication Year, Title, and Total Citations, are fully recorded, ensuring excellent data quality. Additionally, fields such as DOI, Journal, Abstract, Affiliation, and Author have relatively low missing rates (ranging from 0.2% to 1.8%), which is considered manageable and does not significantly impact the dataset's functionality. These fields are crucial for bibliometric analysis, supporting accurate citation tracking and scholarly assessments.

However, certain metadata fields exhibit substantial gaps. Notably, the Corresponding Author field is missing in 40.48% of cases, which may hinder direct communication with researchers and limit the ability to track individual contributions effectively. A more significant concern arises with Keywords and Keywords Plus, which are absent in nearly 60% of records. The lack of these descriptors negatively affects the discoverability and indexing of research articles in academic databases, reducing the dataset's overall utility for keyword-based analysis.

The most critical deficiencies are found in Cited References, Language, and Science Categories, where data is entirely absent (100% missing values). The lack of cited references presents a major challenge for bibliometric and scientometric studies, as it prevents comprehensive analysis of citation networks and academic impact. Similarly, the absence of language and subject classification data limits the dataset's usefulness for disciplinary mapping and linguistic research.

In summary, while the dataset maintains high-quality documentation for core bibliographic elements, the significant gaps in citation tracking, language specification, and subject categorization pose challenges for research assessment. Addressing these deficiencies in future data collection efforts will be crucial for improving the dataset's reliability and enhancing its applicability in scholarly communication and bibliometric studies.

Metadata	Description	Missing Counts	Missing %	Status
DT	Document Type	0	0.00	Excellent
PY	Publication Year	0	0.00	Excellent
TI	Title	0	0.00	Excellent
TC	Total Citation	0	0.00	Excellent
DI	DOI	1	0.20	Good
SO	Journal	3	0.60	Good
AB	Abstract	8	1.60	Good
C1	Affiliation	9	1.80	Good
AU	Author	9	1.80	Good
RP	Corresponding Author	202	40.48	Poor
DE	Keywords	297	59.52	Critical
ID	Keywords Plus	297	59.52	Critical
CR	Cited References	499	100.00	Completely missing
LA	Language	499	100.00	Completely missing
WC	Science Categories	499	100.00	Completely missing

Fig. 1. Result after Initial Screening

Fig. 2. Network graph of the connections between individual terms and their co-occurrence within a dataset

In Figure 2, The visualization employs a network graph where nodes represent individual terms, and the connections (edges) between them indicate their co-occurrence within a given dataset (likely a corpus of text or a set of documents). The size of each node reflects the frequency of the term's occurrence, with larger nodes representing more frequent terms. The placement of nodes and the density of connections illustrate the relationships and clustering of concepts within this domain. The network reveals several key themes and associations. A central cluster, dominated by "economic development," "technology," "poverty," "environment," "conservation of natural resources," "industry," and related terms, highlights the strong link between economic factors, technological advancements, and environmental concerns within the context of bioclimatic design. This cluster suggests a focus on sustainable development, where technological solutions and industrial practices are considered in conjunction with resource management and poverty alleviation.

Another prominent cluster, including "India," "Brazil," "Russia," and "China" (the BRIC nations), along with "humans," "climate change," and "air pollution," emphasizes the geographical and environmental dimensions of the field. This grouping suggests a focus on the impact of human activity and climate change, particularly within the context of these rapidly developing economies.

A smaller, more peripheral cluster, centred around "global health," "health expenditures," "aged," "young adults," and "middle aged," points to the connection between bioclimatic design and public health considerations. This suggests an awareness of the impact of built environments on human health across different age groups.

The varying node sizes and edge thicknesses provide insights into the relative importance and strength of association between concepts. "Economic development" stands out as the largest node, indicating its central role in the discourse. Similarly, the thick edges connecting "economic development" to "technology," "poverty," and "environment" highlight the strong relationships between these concepts.

Publication on BRICS between 2015 and 2024

In Figure 3, the line graph presents the annual scientific production over time, measured in terms of the number of articles published per year. The x-axis represents the publication year, while the y-axis denotes the number of published articles.

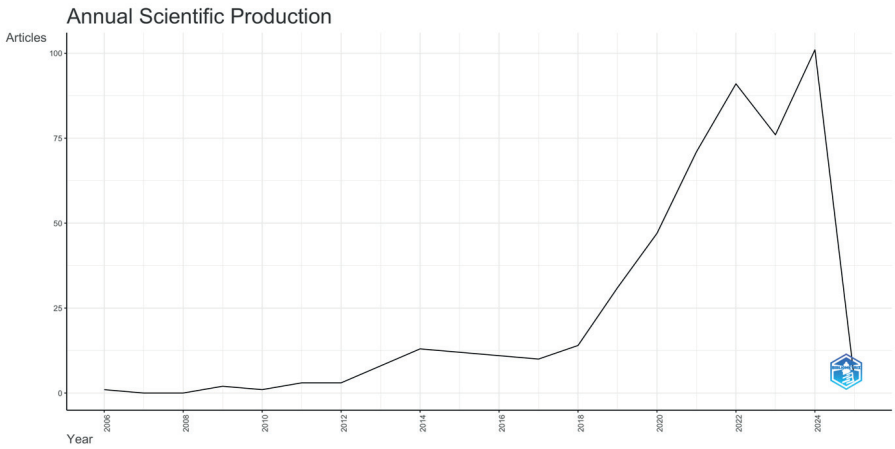

Fig. 3. Annual scientific production over time

The trend indicates a gradual increase in scientific production from 2005 to approximately 2018, with minor fluctuations. Around 2019, there is a noticeable surge in the number of published articles, which continues to rise steeply, peaking between 2021 and 2023. This sharp increase suggests a significant expansion in research output, possibly due to increased academic interest, funding availability, or emerging research trends. However, the data for 2024 shows a drastic decline, with the number of publications dropping sharply compared to previous years. The decline in 2024 could be attributed to multiple factors, including incomplete data collection for the current year, changes in publication policies, reduced research funding, or shifts in scientific priorities.

Overall, the trend highlights the rapid growth in research productivity over the past decade, followed by an unexpected decline in the most recent year. Further investigation is necessary to determine whether the 2024 decrease is due to incomplete data reporting or an actual reduction in scientific output.

Publications on BRICS by countries

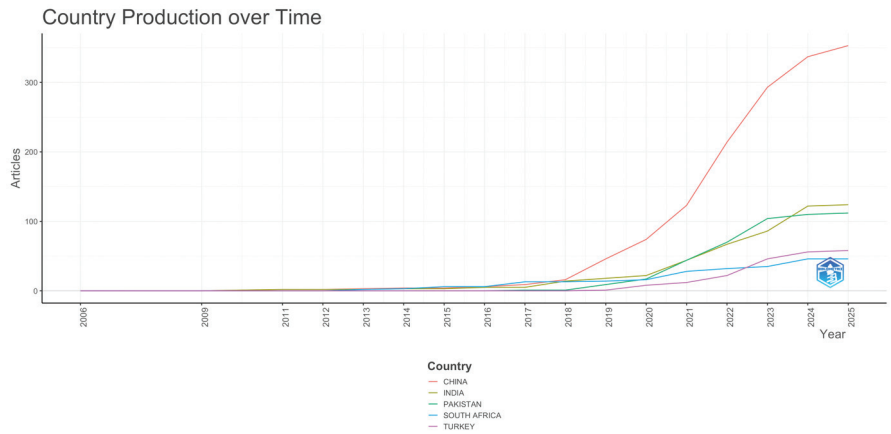

Fig. 4. Country production over time

In figure 4, the line graph illustrates the scientific production trends of five countries (China, India, Pakistan, South Africa, and Turkey) over time, measured in the number of published

articles per year. The x-axis represents the publication year, while the y-axis denotes the number of articles. The analysis of country-wise scientific production over time reveals significant disparities in research output among the five countries–China, India, Pakistan, South Africa, and Turkey. China demonstrates the most substantial growth, particularly after 2018, with an exponential increase in published articles. By 2023–2024, China's research output surpasses 300 articles per year, positioning it as the leading contributor among the analysed countries. This surge can be attributed to increased research funding, government-driven initiatives, and enhanced international collaborations. India and Pakistan also exhibit notable growth in scientific production, albeit at a comparatively slower rate than China. India's research output shows a steady rise from 2018 onward, reaching a plateau in 2023–2024, while Pakistan follows a similar trajectory with an increasing number of publications post-2020. Turkey and South Africa, on the other hand, exhibit a more gradual yet consistent increase in research output. Despite their relatively lower contributions compared to China and India, these countries maintain a steady upward trend, reflecting sustained research activity over the years.

A key observation in the graph is the apparent plateau in 2024 for most countries, which may indicate either an actual stagnation in scientific production or incomplete data collection for the year. Given the substantial increase in research activity post-2018, this trend warrants further investigation to determine whether external factors such as policy changes, funding limitations, or database updates are influencing the observed pattern. Overall, the analysis underscores China's dominance in scientific production, followed by India and Pakistan, while Turkey and South Africa continue to contribute to global research at a steady pace.

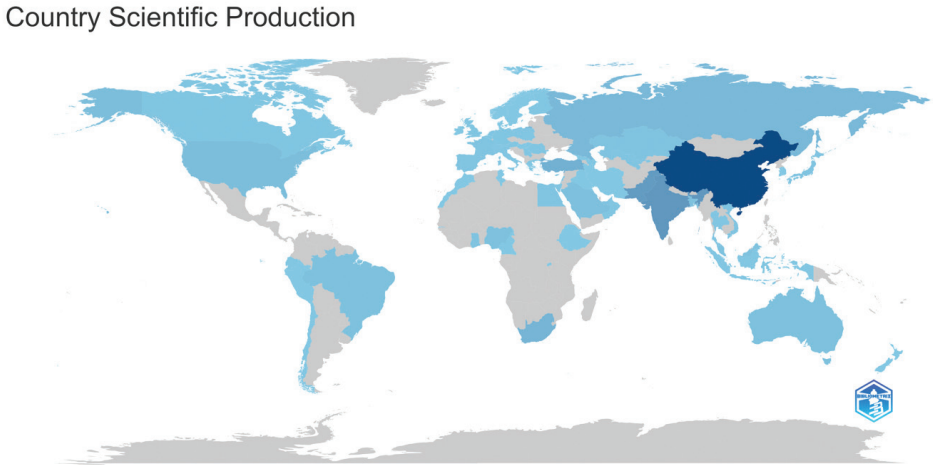

Fig. 5. A global map of the distribution of scientific production across countries

Figure 5 depicts a global map illustrating the distribution of scientific production across countries. The map employs a colour gradient, with darker shades of blue indicating higher levels of scientific output. China stands out as a prominent region, marked by the darkest shade, suggesting it has the highest scientific production among the countries represented. Other notable contributors include the United States, India, Japan, and several European nations. This visualization provides a visual representation of the global scientific landscape, highlighting regions of concentrated research activity.

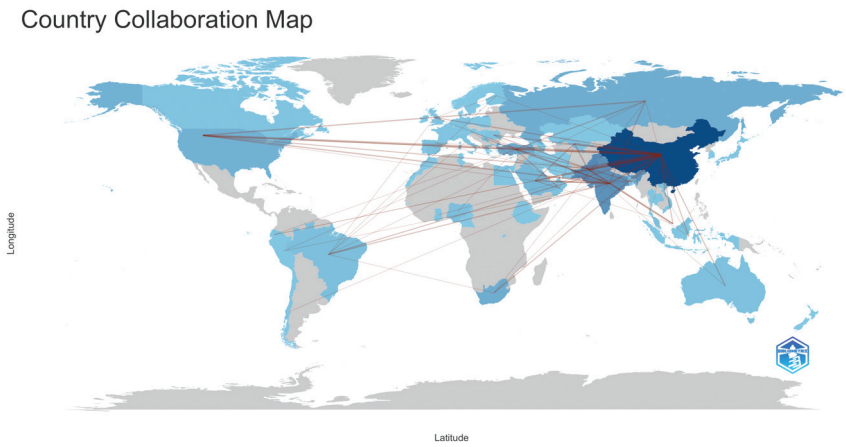

Fig. 6. Patterns of interaction between nations

Figure 6 presents a "Country Collaboration Map" visualizing patterns of interaction between nations. The map employs a world map base upon which collaboration links are overlaid as arcs connecting different countries. National involvement is represented by varying shades of blue, potentially indicating the degree to which a country participates in the collaborative activity, either as a primary collaborator or recipient. The connecting arcs, varying in both thickness and color (red to grey), illustrate the relationships between countries. The thickness of these arcs likely encodes a quantitative measure of the collaboration, such as frequency of interaction, volume of exchange, or strength of the relationship. The colour gradient, from red to grey, may suggest a temporal dimension, differentiating older, more established collaborations (red) from newer ones (grey), or potentially represent qualitative differences in the types of collaboration. Notably, China emerges as a central hub in this network, displaying numerous connections to a wide range of countries, suggesting its significant role in the represented collaborative activity. The United States also exhibits a substantial number of connections, although its role appears less centrally focused than that of China.

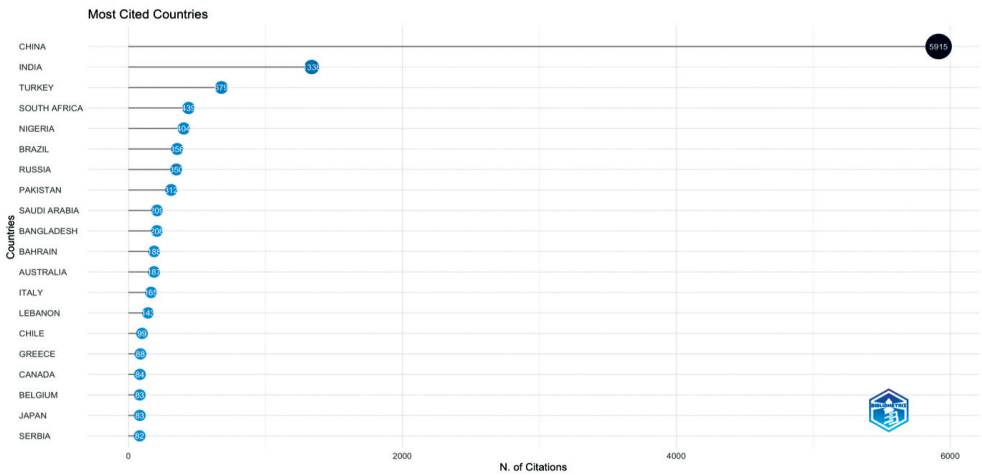

Fig. 7. Most Cited Countries

Figure 7 displays the "Most Cited Countries," presenting a quantitative analysis of citation frequency for a selection of nations. The numerical citation count for each country is explicitly

provided adjacent to the bar representing it, facilitating direct comparison. China emerges as the most cited country, with a significantly higher citation count (5915) compared to all other nations in the dataset. Following China, India holds the second-highest number of citations, although with a substantially lower value. The remaining countries, including Turkey, South Africa, Nigeria, Brazil, Russia, Pakistan, Saudi Arabia, Bangladesh, Bahrain, Australia, Italy, Lebanon, Chile, Greece, Canada, Belgium, Japan, and Serbia, exhibit progressively decreasing citation counts. The consistent decrease in citation numbers across the listed countries suggests a potential ranking or ordering based on citation impact within this specific context. The figure provides a clear and concise visualization of relative citation frequency among the selected countries, highlighting China's prominent position in terms of research impact within the unknown context of this analysis.

Publications on BRICS by Authors

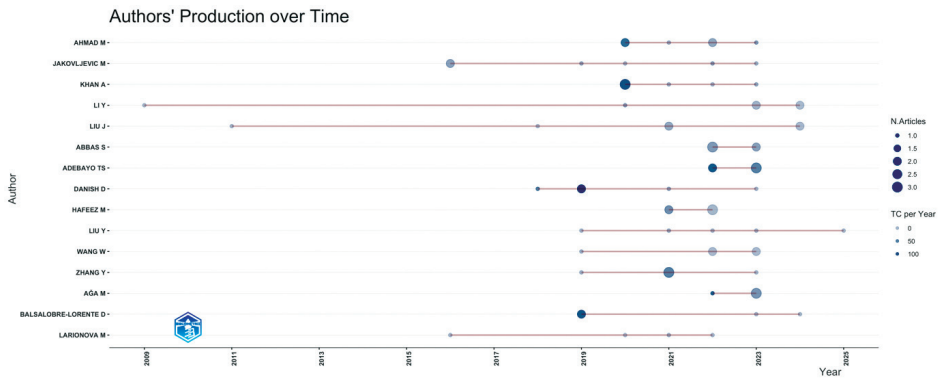

Fig. 8. Authors' Production Over Time

Figure 8 illustrates "Authors' Production Over Time," detailing the scholarly output of individual authors within a specific research domain. The visualization employs a connected scatter plot, where each horizontal line represents an author and the position of the circles along the x-axis indicates the year of publication. The size of each circle corresponds to the number of articles published by that author in a given year, as indicated by the legend for "N. Articles." Additionally, the colour intensity of the circles reflects the "TC per Year" (Total Citations per Year), with a gradient scale provided in the legend.

Several authors demonstrate consistent publication activity across multiple years, as evidenced by the multiple circles along their respective lines. For instance, Ahmad M., Jakovljevic M, Khan A, Li Y, and UU J exhibit a relatively sustained publication record. Conversely, some authors, such as Abbas S, Adebayo TS, and Larionova M, have more sporadic publication patterns. Danish D stands out with a particularly high number of publications in a single year, as indicated by the large circle size. Furthermore, Danish D and Balsalobre Lorente D show a high level of citation impact, as suggested by the darker color intensity of their circles.

The visualization also reveals information about the overall publication timeline within this research area. While publications are sparse before 2015, there is a noticeable increase in activity from 2015 onwards, suggesting a potential growth of research interest in this field during recent years. The data point for Danish D, with high publication and citation counts, indicates a significant contribution to the field. However, it is important to note that the specific research domain, the type of publications considered (e.g., journal articles, conference proceedings), and the source of the citation data are not explicitly stated in the figure. This lack of contextual

information limits a more in-depth interpretation of the authors' contributions and the overall research trends. Despite these limitations, the figure provides a useful overview of individual author productivity and impact within the represented timeframe, highlighting key contributors and suggesting a growing research landscape in the domain.

Additionally, Figure 9 examines "Author Productivity through Lotka's Law," exploring the relationship between the percentage of authors and their corresponding publication output. The visualization presents a line graph with the x-axis representing the number of "Documents Written" and the y-axis denoting the "% of Authors." Two distinct lines are displayed, potentially representing different datasets or models for comparison.

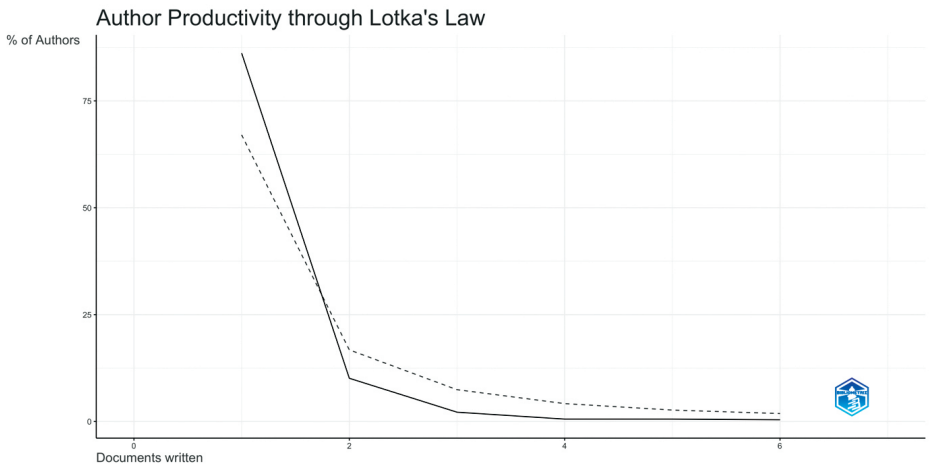

Fig. 9. Relationship between the percentage of authors and their corresponding publication output

The dashed line illustrates a rapid decline in the percentage of authors as the number of documents written increases. Specifically, a substantial percentage of authors (above 75%) have written only one document. This percentage drops sharply as we move to two documents, and the decline continues, albeit at a slower rate, as the number of documents increases further. This pattern suggests that a large majority of authors within the observed dataset are low-output producers, while highly productive authors are significantly less common. The solid line exhibits a similar trend but with slightly different values. It also shows a sharp decrease in the percentage of authors between one and two documents, followed by a gradual decline. However, the percentage of authors at each level of productivity is consistently lower compared to the dashed line. This difference could indicate variations in the data source, time frame, or research field represented by the two lines. Both lines converge towards zero as the number of documents written reaches six, implying that the proportion of authors who have written six or more documents is negligible within this dataset. The visualization provides support for Lotka's Law, which posits an inverse square relationship between the number of publications and the number of authors producing them. This law suggests that a large proportion of scientific work is produced by a small number of authors.

Figure 10 presents a visualization of "Most Relevant Authors" based on their publication output. The chart ranks authors horizontally, with the length of the bars and the number beside each author's name representing the "N. of Documents" (number of documents) they have authored. The authors are listed in descending order of productivity, with Ahmad M, Jakovljevic M, Khan A, Li Y, and Liu J sharing the top rank, each having authored six documents. Following this group, Abbas S, Adebayo Ts, Danish D, Hafeez M, Liu Y, Wang W, and Zhang Y are tied

with five documents each. A third tier of authors, Aga M, Balsalobre-Lorente D, Larionova M, Li H, Mahalik Mk, Ullah S, and Wang Y, have produced four documents each. Agyekum Eb is a notable outlier at the bottom of the ranking, having authored only one document. The visualization effectively communicates the relative productivity of the listed authors. The grouping of authors with identical publication counts is clearly presented, allowing for quick identification of distinct productivity tiers.

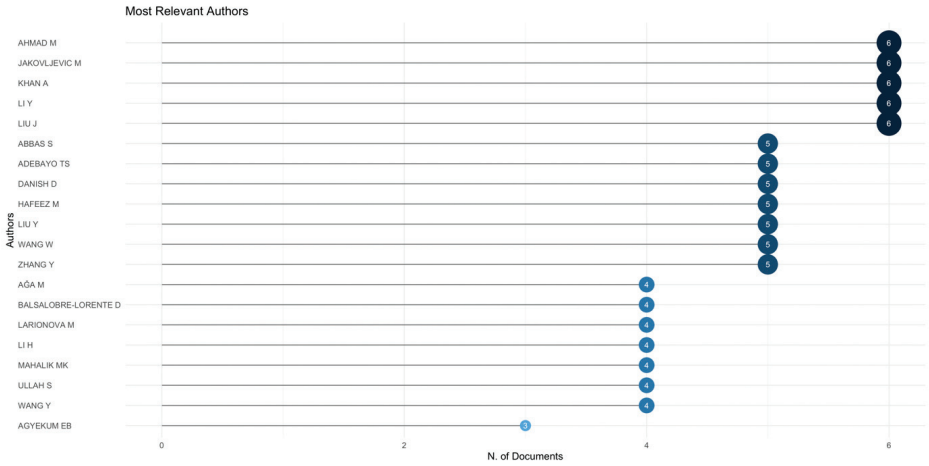

Fig. 10. Most Relevant Authors

Figure 11 depicts "Corresponding Author's Countries," visualizing the distribution of publications based on the corresponding author's nationality. The bars in the chart are segmented into two colours, representing different collaboration types: teal for "Single Country Publications (SCP)" and coral for "Multiple Country Publications (MCP)." China leads in terms of total publications, with a substantial portion categorized as MCP, indicating a high level of international collaboration.

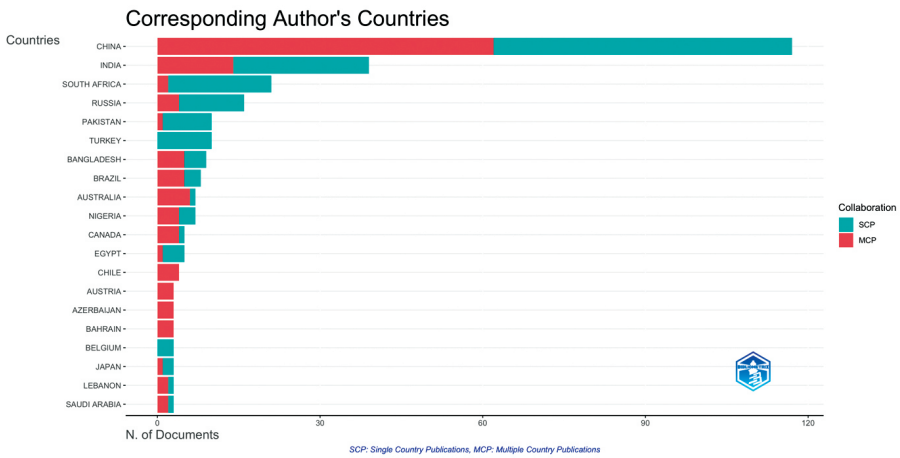

Fig. 11. Distribution of publications based on the corresponding author's nationality

India follows as the second most productive country, also demonstrating a considerable amount of MCP. South Africa, Russia, Pakistan, Turkey, Bangladesh, Brazil, Australia, Nigeria, Canada, Egypt, Chile, Austria, Azerbaijan, Bahrain, Belgium, Japan, Lebanon, and Saudi Arabia

follow in descending order of total publication count. Notably, the proportion of MCP varies across countries. For instance, while China and India exhibit a significant amount of MCP, countries like Russia, Pakistan, and several others show a higher proportion of SCP, suggesting a greater focus on domestic collaborations.

Publications on BRICS by Citations

Figure 11 presents the «Most Global Cited Documents,» ranked according to the number of global citations received. The document authored by Danish D. in 2019, published in «The Science of the Total Environment,» leads with 733 global citations, significantly exceeding the citation count of all other documents in the ranking. Adedoyin FF.'s 2019 publication in the same journal follows with 456 citations. The third most cited document is by Haseeb A. (2018) in «Environmental Science and Pollution Research,» receiving 425 citations. The remaining documents, including those by Khattak Si. (2020), Adebayo Ts. (2022), Nawaz Ma. (2020), Marten R. (2014), Dauda L. (2019), Balsalobre-Lorente D. (2019), Ji X. (2021), Muhammad B. (2021), Farzad S. (2017), Mngumi F. (2022), Bhat Ja. (2018), Khan A. (2020), Jakovljevic M. (2018), Dakhlaoui I. (2016), and Aydin M. (2020), exhibit progressively lower citation counts.

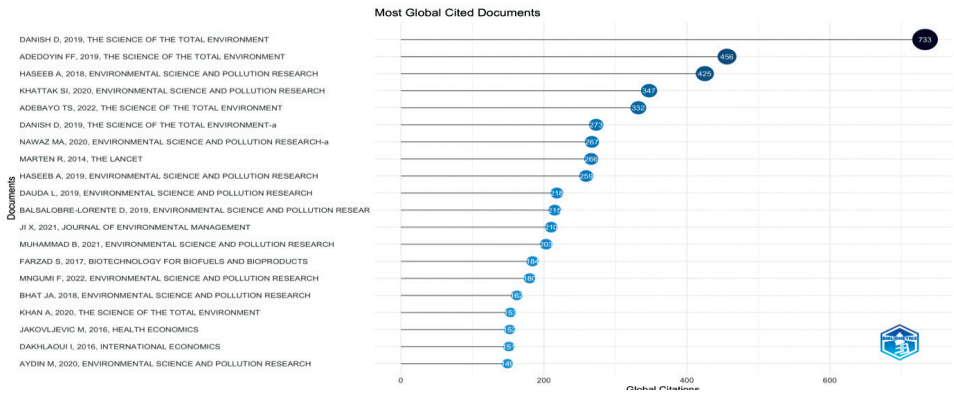

Fig. 12. Most Global Cited Documents

The chart effectively communicates the relative citation impact of these documents, clearly highlighting the most influential publications within this dataset. The horizontal bar format allows for easy comparison of citation numbers across documents.

Publications on BRICS by Most Relevant Affiliations

Figure 13 displays the "Most Relevant Affiliations" based on their contribution to a specific body of research, likely measured by the number of publications or collaborative efforts. Xiangtan Central Hospital, Xiangtan, China emerges as the most prominent affiliation, with a significantly higher number of articles (64) compared to all other listed institutions. This suggests a strong concentration of research output or collaboration originating from this hospital. Following this, several affiliations exhibit a moderate level of contribution, including the Centre For Epidemic Response and Innovation (Ceri), The Department Of Humanities and Social Sciences, Maulana Azad National In, The School Of Management, Jiangsu University, Zhenjiang, People's Republic, and The School Of Management and Economics, Beijing Institute Of Technology. These institutions have article counts in the single digits or low teens. The remaining affiliations, including the China Center For Special Economic Zone Research, Shenzhen University, The Department Of Finance, School Of Business, University Of Cape Coast, The School Of Economics, Quaid-I-Azam University, Islamabad, Pakistan, The School Of Electrical Engineering Guangxi University, Nanning, China, The School Of Management, Jiangsu University, 212013, Zhenjiang,

China, The Institute Of Public Health Of The University Of Porto Ispup, The BRICS-National Institute Of Biomedical Genomics, Kalyani, West Bengal, And The College Of Architecture And Urban Rural Planning, Sichuan Agricultural, all have a relatively low number of articles associated with them.

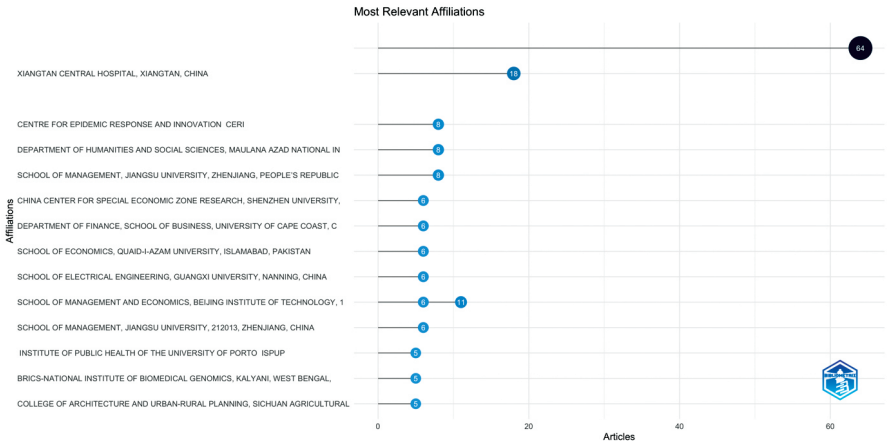

Fig. 13. Most Relevant Affiliations

The visualization effectively highlights the disparity in contribution among different affiliations, with Xiangtan Central Hospital clearly standing out as the most prolific. The horizontal bar chart format allows for easy comparison of article counts across affiliations. However, the figure lacks crucial context for interpreting "relevance." The criteria for selecting these "most relevant affiliations" are not defined. It is unclear whether relevance is solely determined by the number of publications or if other factors, such as citation impact or the quality of publications, are also considered. Furthermore, the specific research domain, the timeframe of the publications, and the nature of the collaboration (e.g., joint publications, shared grants) are not specified. Without this information, it is difficult to assess the broader significance of these affiliations' contributions. Despite these limitations, the figure provides a clear and concise overview of the distribution of research output across different affiliations, highlighting the dominant role of a single institution within the analyzed dataset.

Publications on BRICS by Most Relevant Sources

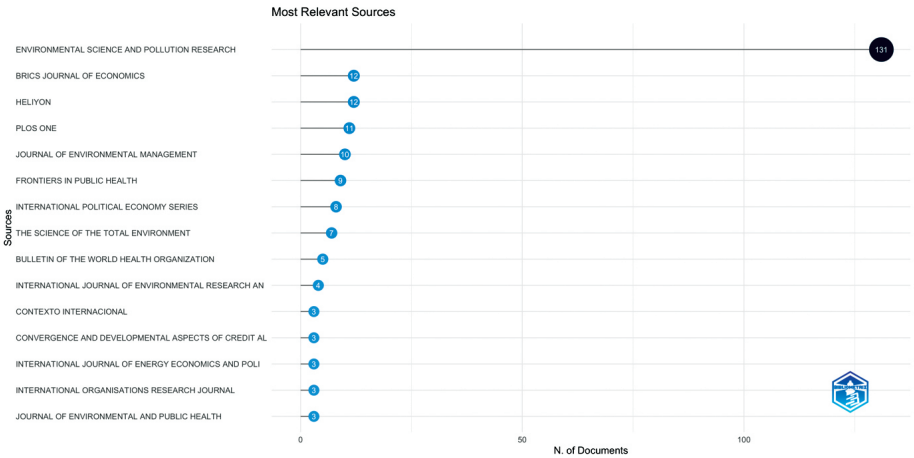

Fig. 14. Most Relevant Sources

Figure 14 displays the "Most Relevant Sources," likely referring to academic journals or publication outlets, ranked by their contribution to a specific body of research. Environmental Science and Pollution Research stands out as the most prominent source, with a significantly higher number of documents (131) compared to all other sources listed. This suggests a strong concentration of relevant research within this particular journal. Following this, BRICS Journal of Economics, Heliyon, PLOS ONE, and the Journal of Environmental Management exhibit a moderate level of contribution, with document counts in the range of 10-12. The remaining sources – Frontiers in Public Health, International Political Economy Series, The Science of the Total Environment, Bulletin of the World Health Organization, International Journal of Environmental Research and, Contexto Internacional, Convergence and Developmental Aspects of Credit AL, International Journal of Energy Economics and Poli, International Organisations Research Journal, and the Journal of Environmental and Public Health – all have a comparatively low number of documents associated with them, typically in the single digits. The visualization effectively demonstrates the distribution of publications across different sources, clearly highlighting the dominance of Environmental Science and Pollution Research. The horizontal bar chart format facilitates easy comparison of document counts across sources.

Trending Topics on BRICS

When it comes to trinding topics on BRICS, refer to figure 15 which visualizes "Trend Topics" over time, illustrating the frequency of specific terms within a given corpus or dataset across a decade, from 2013 to 2023. The visualization employs a connected scatter plot, where the x-axis represents the year and the y-axis lists the individual terms. Each circle's position indicates the year of occurrence, and its size corresponds to the "Term frequency," as shown in the legend.

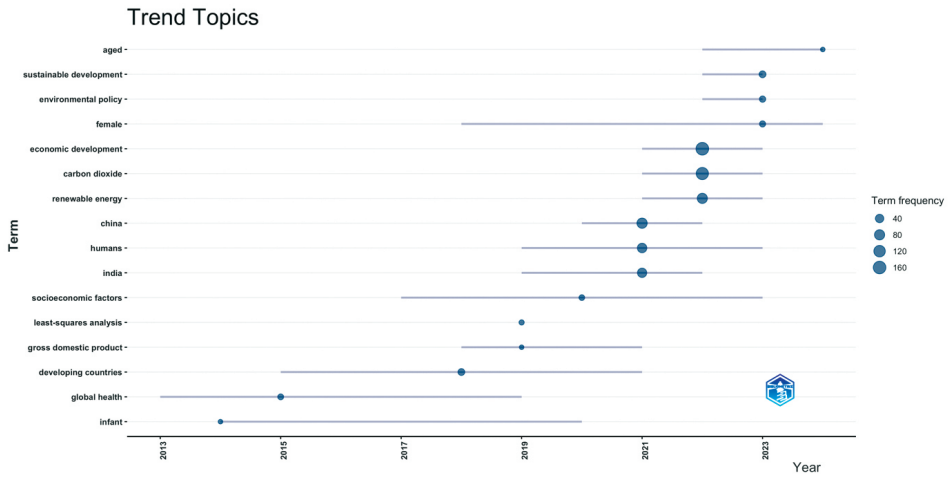

Fig. 15. Trend topics related to BRICS bloc

The figure reveals distinct temporal patterns for different topics. "Aged," "Sustainable Development," "Environmental Policy," "Female," "Economic Development," "Carbon Dioxide," and "Renewable Energy" appear as sustained topics throughout the entire decade, with occurrences in nearly every year. The fluctuating circle sizes for these terms suggest variations in their frequency or prominence over time. "China," "Humans," and "India" also exhibit a presence across the decade, but with more sporadic occurrences and varying frequencies. "Socioeconomic Factors" and "Least-Squares Analysis" appear towards the later part of the decade, suggesting a growing emphasis on these topics in recent years. "Gross Domestic Product" shows a limited

presence in the middle of the decade, while “Developing Countries” and “Global Health” appear more concentrated in the earlier years. “Infant” appears only once, in 2013.

Keyword Analysis on BRICS

Figure 16 presents the “Most Relevant Words” based on their frequency of occurrence within a given text or dataset. “Economic Development” emerges as the most frequently occurring word, with 161 occurrences, significantly surpassing the frequency of all other words in the list. “Carbon Dioxide” follows as the second most frequent word, with 144 occurrences. “China” appears as the third most frequent word, with 82 occurrences. “Renewable Energy” and “Humans” have similar frequencies, with 80 and 63 occurrences, respectively. “India,” “Brazil,” “South Africa,” and “Russia” (the BRICS nations) also appear prominently, with occurrence counts in the 40-60 range. “Environmental Pollution,” “Investments,” and “Carbon” follow, with frequencies in the 30s and 40s. The remaining words – “Internationality,” “Inventions,” “Cross-Sectional Studies,” “Developing Countries,” “Sustainable Development,” “Technology,” “Environmental Policy,” and “Female” – exhibit lower frequencies, generally below 30.

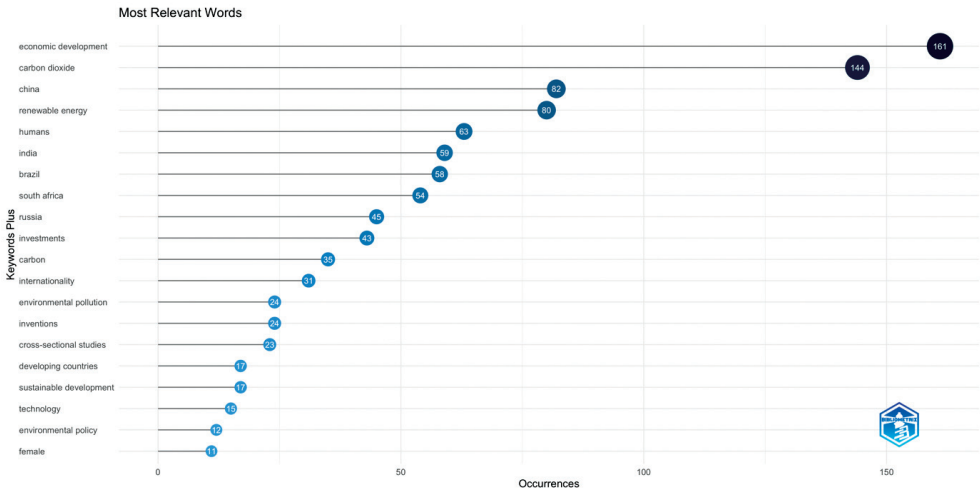

Fig. 16. The most relevenat words in the BRICS-related publications

Additionally figure 16 presents a word cloud visualization of “Most Relevant Words,” visually representing the frequency of terms within a given text or dataset. The size of each word in the cloud is proportional to its frequency, with larger words indicating higher occurrence counts.

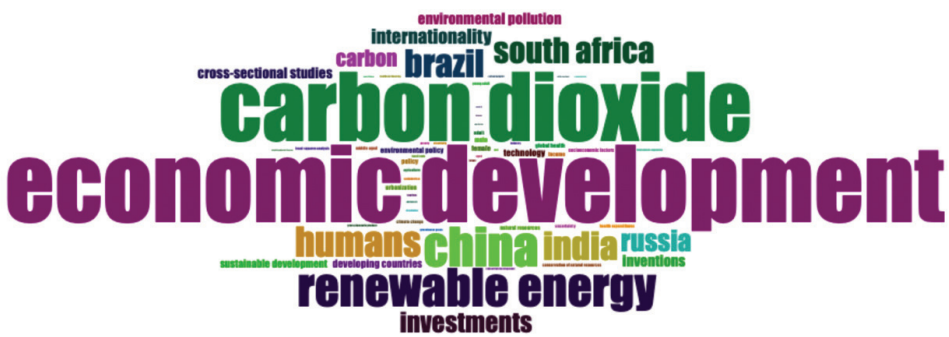

Fig. 17. Cloud of the most relevant words in the BRICS-related articles

The word cloud effectively provides a quick visual overview of the most prominent terms in the text. The varying font sizes allow for easy identification of key themes and concepts. “Economic Development” and “Carbon Dioxide” stand out as the most prominent terms, displayed in the largest font size, indicating their dominant presence in the text. “China,” “Renewable Energy,” and “Humans” also appear as significant terms, though smaller than the top two. The BRICS nations – “India,” “Brazil,” “South Africa,” and “Russia” – are visible as well, suggesting a focus on these countries within the dataset. Other terms such as “Internationality,” “Investments,” “Carbon,” “Environmental Pollution,” “Inventions,” “Cross-Sectional Studies,” “Developing Countries,” “Sustainable Development,” “Technology,” “Environmental Policy,” and “Female” are also included in the word cloud, though in much smaller font sizes, reflecting their relatively lower frequencies.

Conclusion

Interest in the BRICS bloc (or BRICS+) continues to grow, particularly within the fields of economic development and sustainable growth. To evaluate the scope and geographical distribution of scientific engagement with BRICS, a bibliometric analysis was conducted. Key metadata fields, including Document Type, Publication Year, Title, and Total Citations, were utilized to construct a citation network graph, where nodes represent key terms and edges indicate their co-occurrence within a dataset–likely composed of academic publications. The positioning of nodes and the density of their connections illustrate conceptual clustering and thematic relationships within BRICS-related research.

Key Findings from the Citation Network:

The network analysis reveals several prominent research clusters:

Economic & Environmental Interconnections:

A central cluster is dominated by terms such as «economic development,» «technology,» «poverty,» «environment,» «conservation of natural resources,» and «industry.» This highlights the strong interconnections between economic growth, technological advancements, and environmental sustainability. The findings suggest that bioclimatic design plays a crucial role in sustainable development, with technological and industrial strategies aligning with resource management and poverty reduction efforts.

Geopolitical & Climate Considerations:

Another key grouping includes the BRIC nations–India, Brazil, Russia, and China–alongside terms such as «humans,» «climate change,» and «air pollution.» This cluster underscores the geographic and environmental aspects of BRICS research, particularly the impact of human activity and climate change in rapidly developing economies.

Public Health & Social Impact:

A smaller, peripheral cluster focuses on public health concerns, with terms like «global health,» «health expenditures,» «aged,» «young adults,» and «middle aged.» This suggests growing recognition of the interplay between bioclimatic design and human health outcomes across different age groups.

Trends in Scientific Production:

The research trajectory shows a rapid increase in academic output over the past decade, followed by an unexpected decline in 2024. Further analysis is needed to determine whether this apparent drop is due to incomplete data collection or an actual reduction in scientific interest.

A corresponding line graph tracks research output in five countries–China, India, Pakistan, South Africa, and Turkey – measuring annual publication volumes. Notably, 2024 exhibits a plateau in research output, which could indicate either a stagnation in productivity or delays in data reporting.

China emerges as the central hub in the research network, displaying extensive collaborations with other countries. The United States also exhibits strong connectivity, though its role appears less central compared to China.

Overall, these findings illustrate the evolving landscape of BRICS-related research, emphasizing its intersection with economic, environmental, and public health dimensions while highlighting the shifting trends in global academic collaboration.

Limitations of the study

The reliance on the Dimensions database as the primary data source presents a limitation, as it may not encompass all relevant publications retrieved by the search query. To address this constraint, some researchers have opted for a multi-database approach, incorporating sources such as Scopus, Web of Science, EBSCO, and other academic databases to ensure broader coverage and a more comprehensive dataset.

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Вклад авторов

Ринго Н. – поиск метаданных, описание контекста исследования, составление черновика статьи, написание обзора литературы и заключения.

Нандваль А. – описание методологической части исследования, проведение библиометрического анализа и его интерпретация.

Authors' contribution

Ringo N. – searching for metadata, description of the research context, drafting the article, writing the literature review and conclusion.

Nandwal A. – description of the methodological part of the research, conducting the bibliometric analysis and its interpretation.

Конфликт интересов

Авторы заявляют об отсутствии конфликта интересов.

Conflict of interests

The authors declare no relevant conflict of interest.