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Original Research

Research Trends on Climate Change Publications in Brics Countries: A Scientometrics Analysis

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Abstract

The utility of scientometric considerations helps in dynamic/approach making. Technology forecasting provides an informed view of technology, its development, and future trends and is an essential tool in decision-making. BRICS is the abbreviation authored for a relationship of five significant arising public economies such as Brazil, Russia, India, China, and South Africa. The BRICS nations are now fortifying collaboration to battle environmental change through a progression of joint goals. The BRICS should deliver these by consenting to make and advance the strides logically known to do the most to control environmental changes. Scientometrics is progressively being applied in science strategy examines. The present study attempted to find the year-wise, language, document type, and keyword-wise distribution of articles in Climate Change research and to study the authorship pattern and collaboration in climate change research. It attempted to present the exponential growth rate of Climate change and top-cited documents in Climate change research. Using the search term “Climate Change” the data were retrieved from the Web of Science from 1994 to 2018. Totally, 30,270 records were downloaded and analyzed by using Bibexcel. The collected data have been analyzed with the Bibexcel and VOS viewer and presented in the form of tables and pictures. The study found that more number of articles published in the year 2018 was 5756, and most documents were published in English; multiple authors contributed 96% of the articles. It is understood that PLOS One published 581 documents, lesser level of exponential growth rate noticed in 2009 was 0.7. The significance of the support of Brazil and BRICS in a global environmental change system has been perceived for quite a while. The present research exploration discussed the distributions of BRICS, which have taken for following climate change publications. They feature that worldwide climate change activity can't be effective without BRICS nations' contribution.

Keywords: Scientometrics, Climate Change, Bibliometrics, Research Trends, Brics Countries.

Introduction

Climate change has gained increasing attention in the natural sciences and, more recently, in the social and political sciences. Scientists actively work to understand the past climate and predict the future climate by using observations and theoretical models. Various subfields are

interlinked in physics, chemistry, meteorology, and geosciences (atmospheric chemistry and physics, geochemistry and geophysics, oceanography, paleoclimatology, etc.). Climate change has also become a major political, economic, and environmental issue during the last decade and a central theme in many political and public debates. How to address, mitigate and adapt to climate change has become a hot issue. The scientific community has contributed extensively to these debates with various data, discussions, and projections on the future climate and the effects and risks of the expected climatic change. The large and growing amount of climate change researchliterature has brought about that scientists are working within this research field experience increasingly problems maintaining a view over their discipline. Modern information systems could offer databases and analysis tools, providing a better overview of the entire research field. However, many experts do not take advantage of a lack of access and experience concerning suitable databases and analysis tools. But meanwhile, a series of bibliometrics analyses have been published by scientometricians, stimulated by the growing scientific, political, and public attention to research on climate change.

The utility of scientometric contemplates helps in dynamic/strategy making. Innovation estimating gives an educated view regarding innovation, its turn of events, and future patterns and henceforth is a significant apparatus in dynamics. Scientometrics is progressively being applied in science strategy contemplates. Pointers built from scientometrics can uncover the elements of an exploration field, how it is created, and the center skill of various research gatherings or countries on the loose. It can show gaps in the nation's research profile and distinguish how much its exploration can educate mechanical turn of events or show a firm/nation's innovation readiness. In innovation determination, Scientometrics is assuming a key job. It accommodates the chief or potentially specialists/research gatherings to have a more educated arrangement regarding the improvement in a field and considers extrapolation through anticipating strategies for how the field is required to create. This is helpful for choice-based investigation; for example, subsidizing support, making the guide, attempting critical choices, and so forth scientometric approach requires further thoughtfulness to make it more satisfactory to established researchers and science strategy/dynamic.

Profile of BRICS Countries

BRICS is the abbreviation begat for a relationship of five significant arising public economies: Brazil, Russia, India, China, and South Africa. The BRICS members are known for their critical effect on territorial issues. Since 2009, the BRICS countries have met every year at formal culminations. Brazil facilitated the latest eleventh BRICS highest point on 13- 14 November 2019. Initially, the initial four were assembled as "BRIC" (or "the BRICs"), before the acceptance of South Africa in 2010. The BRICS have a joined region of 39,746,220 km2 (15,346,101.0 sq mi) and an expected all-out populace of about 3.21 billion, or about 27% of the world land surface and 41% of the total populace. Four out of five individuals are among the world's ten biggest nations by the populace and by zone, asidefrom South Africa, the twenty-fourth in both. The expression "BRIC" is accepted to be instituted in 2001 by then-executive of Goldman Sachs Asset Management, Jim O'Neill, inhis distribution of building better global economic BRICs. Be that as it may, it was instituted by Roopa Purushothaman, a Research Assistant, in the first report. The unfamiliar priests of the underlying four BRIC General states (Brazil, Russia, India, and China) met in New York City in September 2006 at the edges of the General Debate of the UN Assembly, starting a progression of elevated-level

gatherings. A full-scale political gathering was held inYekaterinburg, Russia, on 16 June 2009.

Climate change strategies for BRICS can be isolated into two sections based on the order. Those trailed by BRICS nations independently before the origin of BRICS and those that result from BRICS's highest points regarding environmental change. The hypothesis of BRICS environmental change strategies requests disregarding the previous and thinking about the last as a cooperative exertion. A significant part of the discussion on ecological change by BRICS has been on theoretical grounds overlooking the official explanations and endorsements. The fact of the matter is to remember just those issues for BRICS environmental change arrangements reflected in the BRICS highest points official reports or oral deliveries. The explanation being only nations in BRICS make separate atmosphere moves, yet when they meet up, it is really at that time that they structure approaches that can be supposed to be of BRICS nations.

BRICS Climate Change Capacities

In 2018 the five BRICS nations represented 42% of worldwide ozone-depleting substance discharges, with 36,573 MtCOs. China was the world's first-positioned producer with 28% of the worldwide aggregate, continued in second, removed by the United States with 15%. In the third and fourth came India with 7% and Russia with 5%. South Africa stood thirteenth and Brazil fourteenth with about 1% each. Three BRICS individuals delivered around 75% (72.5 %) of the outflows of the world's four main carbon polluters. Theypositioned in front of the G7 nations of Japan, Germany, and Canada. South Africa and Brazilremained in front of the United Kingdom, Italy, and France. With 42% of worldwide discharges, the BRICS delivered practically twofold the G7 out of 24%. Together BRICS individuals range the world's significant atmosphere zones, from Russia's Arctic to Brazil's jungles, to South Africa's grape plantations, China's deserts, and India's mountain tops. Also, as the BRICS climate pastors perceived at their gathering in 2016, "BRICS nations comprise huge pieces of the World's populace, land region, and regular assets; consequently, the decisions that we make have worldwide centrality."

Literature Review

Wang, Zhao and Wang (2018) investigated tremendous writing on the Climate Change dataset from WOS utilizing bibliometrics. The outcomes demonstrated that the field ofclimate change variation had entered a phase of a quick turn of events. The USA involves the central position. Climatic change is the most gainful diary; Ford JD from Canada was the most profitable creator and the Chinese Academy of Science's most beneficial exploration foundation on environmental change. A coordinated effort in this field keeps reinforcing, yet the development rates at public levels are generally low. Deng, Zhang, Qin, Yao & Deng (2017) led the relative quantitative and subjective i,nvestigation of climate change research related to lakes utilizing a bibliometric examination dependent on SCI. The analysis considered ten thousand two hundred ninety-six papers from 1266 diaries. The rapid growth of literature pointed out since 2000. Before the 2000s, most research looked at pale limnology. Lately, eutrophicationdisplayed one of the most noteworthy co-event frequencies with climate change. The critical expanding pattern was seen between climate change and remote detecting, a cutting-edge innovation presently broadly utilized in limnology. As of late, more research has focused on current limnology.

Lukwale and Sife (2017) led to survey research patterns on climate change in Tanzania structure 2006 - 2016 from Google Scholar and took 319 distributions. The examination showed that as the pace of development of distributions expanded, the comparing multiplyingtime diminished. A large portion of the archives as Journals articles and distributed under Climate change transformation. The DC was 0.69 expressed about the masteries of multiple authors. The research recommended that the exploration development on climate change in Tanzania is low contrasted, and different nations and endeavors needed to focus on climate change research. Marx, Haunschild and Bornmann (2017) investigated the examination field of climate change in a mix with tea production and 14 key papers managing the ramifications of climate change for tea creation, just as 71 papers referring to one of the keywords in any event. The research represents the significance of climate change for tea creation and mirrors the rising conversation on climate change effects and variation systems. The examination uncovered that M.A. Wijeratne, Tea Research Institute (TRI) in Sri Lanka, was the first commitment to the distributions, and as of now, the exploration theme is invigorated by research activities and distributions.

Djalante (2016) demonstrated research studies on Natural Hazards, Disasters, Risk Reduction, and Climate Change from Indonesia published in the SCOPUS database from 1900 to 2016. Global and non-Indonesian authors overwhelmed the number of specialists, and Indonesians co-author just 50% of the distributions. In addition, worldwide joint efforts occurred simply by local Indonesian associations. Twenty local encounters could contribute to collaborative efforts, strategic maneuver among scientists, absence of limitations concerning the exploration, frail English scholarly works limit, and lack of motivations forworldwide joint actions and distributions inside the Indonesia advanced education framework. Haunschild, Bornmann and Marx (2016) directed the bibliometric concentrate on climate change distributions from 1980 to 2014, dependent on 222060 archives. The twofold proportion of the distributions of climate change is noticed every 5-6 years. The more significant part of the distributions identified with Continental biomass and a lesser number of distributions variation, alleviations, and Vulnerability; however, it found the commitments expanding from2005. USA, UK, Germany, and Canada were the most overwhelmed nations examining environmental change. The UK had the most suggestions for references. At last, the term model and related terms unmistakably seem autonomous of time, showing the high pertinence of atmosphere displayed.

Prasad, Pande, Singh and Prasad (2016) analyzed the publications from Scopus on the Himalayas through scientometrics concentrated from 1989 to 2014. Among 1707 the overall distributions got 255179 references and determined the citation per paper as 14.94. Among the Indian authors, 7277 publications and 56134 references were seen, with 7.71 citations per paper. Among the Himalayas research, India contributed 33% of the publications with the first position. The analysis estimated the collaborative research markable one. It is seen that the nature of examination was influenced by deficient aptitude, the absence of uniform techniques and instrumentation, and information assortment and combination conventions. Husain and Mushtaq (2015) explored the publication of climate change from WOS in natural science and biology from 2009 to 2013. The number of 17266 distributions are documents taken for the research-based keyword around the globe, and a significant distribution level observed in 2013 at 4788 and a low level in 2009 at 2238. USA and England published more articles in this regard, and W. Thuiller and P. Smith were noticed as productive authors in the field of climate

change. The productive diaries were Climatic Change and Global Change Biology.

Saravanan, Rajan, Prasad and Muthusankar (2014) featured the development and improvement of climate change publications quantitatively regarding distribution yield according to WOS from 1991 to 2012 and focused on the publications from Argentina, Brazil, China, India, and Mexico. Among the 7065 publications, the Chinese Academy of Science, China contributed more distributions, and the Geoscience subject offered more exploration on the point. Country-wise environmental change contributions and the most productive authors for the five nations have been recognized. Wang, Pan, Ke, Wang and Wei (2014) considered the 3,004 papers distributed in 658 publications through WOS on climate change vulnerability from 1991 to 2012. The vulnerability investigation of climate change has encountered a fast development since 2006, and the distributions are broadly appropriated in many source diaries. The collaboration at the author level is on the ascent, and there are nearer connectionsbetween institutional and public groups. The most broadly engaged research themes in this field incorporate medical problems in the financial framework and food security.

Belter and Seidel (2013) directed the bibliometric research on climate engineering exploration from 1988 to 2011. Distributions on atmosphere designing incorporated a higher than average level of non-research articles and were predominately created by nations inthe Northern Hemisphere and communicated in English. Most of this writing centers around land-based techniques for carbon sequestration, sea iron treatment, and sun-oriented radiation executives. This investigation gave a gauge to observe the advancement of climate engineering research later. Venkatesan, Srinivasan, Gopalakrishnan, Gnanasekaran and Duraisamy (2013) distinguished the development of writing and executionof Indian researchers on climate change in India. From WOS, 94756 records were recovered from 1999 to 2012. 1.74 distributions contributed by Indian scientists. The most well-known exploration subjects are ecological science, biology, and geography. The investigation recommended giving consideration, and financing should be engaged. The absence of assets for the exploration is a significant disadvantage to the scientists since just 20% of the activitieswere subsidized by the offices during the investigation.

Bjurström and Polk (2011) showed about the IPCC Third Assessment Report, which explored the Earth, Biological and Social sciences. The examination network subsequently forces a physical and financial inclination and a partition of logical fields that the IPCC repeats in the strategy circle. It is contended that this physical and monetary inclination misshapes a thorough comprehension of environmental change and that the feeble coordination of logical fields obstructs environmental change from being wholly tendedto as a vital natural and social issue. Li, Wang and Ho (2011) considered assessing the worldwide publications of climate change research from 1992 to 2009. Articles alluding to climate change were surveyed by the distribution of nations, institutions, paper titles, author Keywords, Keywords Plus, abstracts, and the most referred to articles in these years. By examining the four sorts of keywords, it was inferred that the things temperature, climate, precipitation, ozone harming substance, will be the attention of environmental change research on the model and observation. Phylogeography may have a solid application potential soon. Stanhill (2001) considered the development of climate change science, showing 7000 distributions multiplying at regular intervals. It is determined that the distribution per author is 1.7 and authors per paper 2.5 climate change research annually. It is pointed out that cost per distributing researcher is exceptionally highto a great extent in light of the wholes allotted to satellite projects identified with environmental

change research. The worldwide expense of flow environmental change research is assessed at three billion U.S. dollars yearly. The significance of extra-logical components in controlling the development of environmental change considers is stressed.

Assessing research activity on climate change is a broad scientific topic, and the theme becomes a researcher's debate. The literature review clearly shows that using scientific measurement methods, and most research has been done on environmental change, continental biomass, natural sciences, biology, natural hazards, and climate change. In climate change, scientific metrology attempts to identify the position of various countries based on publication output. Many studies are related to sub-areas of climate change. In response to necessary and sufficient information, this study takes appropriate steps to bridge the gap in research, and the present study is an attempt to identify research trends on climate change in BRICS countries.

Objectives

- To find the year-wise, language, document type, and keyword-wise distribution ofarticles in Climate Change research
- The study of the authorship pattern and authorship collaboration on climate change research
- To find out the source-wise and country-wise distribution of articles in Climatechange research.
- To present the exponential growth rate of Climate change and top-cited documents in Climate change research

Methods and Materials

Using the search term "Climate Change" the data were retrieved from the Web of Science from 1994 to 2018. The study considered taking all the data on the study period. Totally 30,270 records were downloaded and analyzed by using Bibexcel. The collected data have been analyzed with the Bibexcel, and VOS viewer and presented in the form of tables and pictures.

Results

Table 1 shows the total number of documents published on Climate change indexed on the web of science from 1994 to 2018. It is noticed from the table that more articles were published in the year 2018 (5756), 2017 (4605), and 2016 (3523). Lesser number of articles published in 1996 (43), 1995 (39), and 1994 (13)

Table 1
Year-wise Distribution of Publications

S. No.	Year of the Publications	Records	Percentage
1	1994	13	0.04
2	1995	43	0.14
3	1996	39	0.13
4	1997	47	0.16
5	1998	52	0.17
6	1999	64	0.21
7	2000	84	0.28

8	2001	107	0.35
9	2002	156	0.52
10	2003	175	0.58
11	2004	221	0.73
12	2005	280	0.93
13	2006	340	1.12
14	2007	500	1.65
15	2008	1100	3.63
16	2009	775	2.56
17	2010	1093	3.61
18	2011	957	3.16
19	2012	2038	6.73
20	2013	2300	7.60
21	2014	2709	8.95
22	2015	3293	10.88
23	2016	3523	11.64
24	2017	4605	15.21
25	2018	5756	19.02
	Total	**30270**	**100**

Table 2 presents the language-wise distribution of publications on climate change. It is noticed that 98.65% (29930) of documents were published in the English language. Results showed that 138 and 117 documents were published in Chinese and Portuguese.

Table 2
Language-wise Distribution of Publications

S.No.	Languages	Records	Percentage
1	English	29930	98.87
2	Chinese	138	0.46
3	Portuguese	117	0.39
4	Russian	39	0.12
5	German	17	0.05
6	Spanish	13	0.04
7	French	11	0.03
8	Dutch	2	0.01
9	Portuguese	1	0.01
10	Serbian	1	0.01
11	Afrikaans	1	0.01
	Total	**30270**	**100**

The document-wise distribution of publications on climate change in the study period is shown in Table 3. It is noticed that 26823 documents (88.61%) were articles. 1872 (6.18%) documents were reviewed. 689 (2.27) documents were articles and proceedings papers. 396 (1.30%) of the documents were editorial materials.

Table 3
Document-wise distribution of the publication

S.No.	Types of Document	Records	Percentage
1	Article	26823	88.6125
2	Review	1872	6.1843
3	Article; Proceedings Paper	689	2.2762
4	Editorial Material	396	1.3082
5	Review; Book Chapter	146	0.4823
6	Article	86	0.2841
7	Letter	73	0.2412
8	Meeting Abstract	72	0.2379
9	Book Review	25	0.0826
10	Article; Data Paper	25	0.0826
11	Correction	17	0.0562
12	Article; Book Chapter	14	0.0463
13	News Item	11	0.0363
14	Review	5	0.0165
15	Chronology	4	0.0132
16	Article; Retracted Publication	3	0.0099
17	Reprint	2	0.0066
18	Editorial Material	2	0.0066
19	Correction	1	0.0033
20	Retraction	1	0.0033
21	Editorial Material	1	0.0033
22	Article; Proceedings Paper	1	0.0033
23	Note	1	0.0033
	Total	**30270**	**100**

Table 4 shows the authorship pattern of the publication on climate change. It is noticed that multiple authors contributed 96% of the articles. Single authors contributed only 4% of the publications

Table 4
Authorship pattern

S.No.	Authorship pattern	Records	Percentage
1	Single author	1214	4.01
2	Multiple author	29056	95.99
	Total	30270	100

The authorship of collaboration on climate change research is represented in Table 5. During the study period, 16.63% of the articles were contributed by four authors, 15.35% of the articles were contributed by five years, and three authors contributed 15%. Double authors contributed 11.31% of the articles. Seven authors contributed 8.02% of the articles. More than ten authors contributed 7.34% of the articles.

Table 5
Authorship collaboration

S.No.	Authors	No. of Publications	Percentage
1	Single Author	1214	4.01
2	Double Authors	3424	11.31
3	Three Authors	4539	15.00
4	Four Authors	5033	16.63
5	Five Authors	4647	15.35
6	Six Authors	3400	11.23
7	Seven Authors	2428	8.02
8	Eight Authors	1576	5.21
9	Nine Authors	1097	3.62
10	Ten Authors	689	2.28
11	Above Ten Authors	2223	7.34
	Total	**30270**	**100**

Table 6 shows the source-wise distribution of the publications on climate change. It is understood that PLOS One published 581 documents, Science of the Total Environment published 512 documents, Scientific Reports published 478 documents, Global Change Biology published 372 documents, and Quaternary International published 342 documents.

Table 6
Source-wise Distribution of Publications

S.No.	Types of Sources	Records	Percentage
1	PLOS One	581	1.92
2	Science of the Total Environment	512	1.69
3	Scientific Reports	478	1.58
4	Global Change Biology	372	1.23
5	Quaternary International	342	1.13
6	Current Science	331	1.09
7	Journal of Hydrology	323	1.07
8	Journal of Cleaner Production	319	1.05
9	International Journal of Climatology	317	1.05
10	Sustainability	316	1.04
11	Climatic Change	298	0.98
12	Water	276	0.91
13	Theoretical and Applied Climatology	272	0.9
14	Journal of Geophysical Research-Atmospheres	271	0.9
15	Agricultural and Forest Meteorology	251	0.83
16	Paleogeography Paleo climatology Paleoecology	239	0.79
17	Environmental Research Letters	231	0.76
18	Chinese Science Bulletin	230	0.76
19	Geophysical Research Letters	218	0.72

S.No.	Types of Sources	Records	Percentage
20	Journal of Climate	218	0.72

The distribution of the keywords in the publications on climate change is shown in Table 7. Itis noticed that 30.6% of the article published about climate change. 6.13% of the articles werepublished on the Variability keyword. Around 5.58% of the documents were published on theTemperature keyword. 4.72% of the documents were published as China keywords.

Table 7
Keyword-wise distribution

S.No.	Keywords	Records	Percentage
1	Climate change	11671	30.6
2	Variability	2337	6.13
3	Temperature	2129	5.58
4	China	1799	4.72
5	Model	1767	4.63
6	Impacts	1749	4.59
7	Precipitation	1495	3.92
8	Impact	1368	3.59
9	Trends	1281	3.36
10	Management	1178	3.09
11	Responses	1129	2.96
12	Dynamics	1112	2.92
13	Climate	1035	2.71
14	Growth	1023	2.68
15	Vegetation	1010	2.65
16	Patterns	886	2.32
17	Water	755	1.98
18	United-states	722	1.89
19	Carbon	719	1.88
20	Land-use	717	1.88

Table 8 shows the top countries contributing publications to climate change research. It is noticed that the People's Republic of China ranked first with the contributions of 17670 records. The USA ranked second with 7170 publications, and India ranked third with 4008 publications. Brazil ranked fourth with 3321 publications, and South Africa contributed 2978 publications, ranking fifth.

Table 8
Country Collaboration

S.No.	Countries	Records	Percentage
1	Peoples R China	17670	29.18
2	USA	7170	11.84
3	India	4008	6.62

4	Brazil	3321	5.48
5	South Africa	2978	4.92
6	UK	2689	4.44
7	Australia	2157	3.56
8	Germany	2139	3.53
9	Russia	1974	3.26
10	Canada	1569	2.59
11	France	1341	2.21
12	Japan	964	1.59
13	Netherlands	905	1.49
14	Sweden	881	1.45
15	Switzerland	684	1.13
16	Spain	670	1.11
17	Norway	638	1.05
18	Italy	633	1.05
19	Denmark	540	0.89
20	Finland	485	0.8
21	Austria	401	0.66
22	Belgium	368	0.61
23	New Zealand	304	0.5
24	South Korea	266	0.44
25	Taiwan	259	0.43
26	Portugal	253	0.42
27	Mexico	226	0.37
28	Kenya	221	0.36
29	Singapore	202	0.33
30	Argentina	195	0.32

Table 9 presents the exponential growth rate of climate change research in the selected study period. It is noticed that 3.31 was a high level of EGR in 1995, and 2.2 was detected in 2008. A lesser level of exponential growth rate was seen in 2009 as 0.7.

Table 9
Exponential Growth Rate

S.No.	Year	Records	Exponential GrowthRate
1	1994	13	0
2	1995	43	3.31
3	1996	39	0.91
4	1997	47	1.21
5	1998	52	1.11
6	1999	64	1.23
7	2000	84	1.31

8	2001	107	1.27
9	2002	156	1.46
10	2003	175	1.12
11	2004	221	1.26
12	2005	280	1.27
13	2006	340	1.21
14	2007	500	1.47
15	2008	1100	2.2
16	2009	775	0.7
17	2010	1093	1.41
18	2011	957	0.88
19	2012	2038	2.13
20	2013	2300	1.13
21	2014	2709	1.18
22	2015	3293	1.22
23	2016	3523	1.07
24	2017	4605	1.31
25	2018	5756	1.25
	Total	**30270**	**32.62**

The topmost cited documents is presented in Table 10. Among the top 30 cited documents, with 764 citations, *Mann HB, 1945, V13, P245, Econometrica* ranked first, *Solomon S, 2007, P19, Climate Change 2007: The Physical Science Basis* ranked second with 703 citations, Hijmans RJ, 2005, V25, P1965, Int J Climatol ranked third with 702 citations, *Taylor KE, 2012, V93, P485, B Am Meteorol Soc* ranked fourth with 596 citations, *Kalnay E, 1996, V77, P437, B Am Meteorol Soc* ranked fifth with 594 citations.

Table 10
Topmost Cited Documents

S.No.	Sources	Citations	Rank
1	Mann HB, 1945, V13, P245, Econometrica	764	1
2	Solomon S, 2007, P19, Climate Change 2007: The Physical Science Basis	703	2
3	Hijmans RJ, 2005, V25, P1965, Int J Climatol	702	3
4	Taylor KE, 2012, V93, P485, B Am Meteorol Soc	596	4
5	Kalnay E, 1996, V77, P437, B Am Meteorol Soc	594	5
6	Piao SL, 2010, V467, P43, Nature	539	6
7	Bagstad KJ, 2013, V5, Pe27, Ecosyst Serv	505	7
8	Walther GR, 2002, V416, P389, Nature	496	8
9	Parmesan C, 2003, V421, P37, Nature	476	9
10	Phillips SJ, 2006, V190, P231, Ecol Model	454	10
11	Sen PK, 1968, V63, P1379, J Am Stat Assoc	434	11
12	Davidson EA, 2006, V440, P165, Nature	422	12
13	Myers N, 2000, V403, P853, Nature	388	13
14	Ipcc, 2007, Climate Change 2007	385	14
15	Immerzeel WW, 2010, V328, P1382, Science	378	15
16	Lal R, 2004, V304, P1623, Science	358	16
17	Liu XD, 2000, V20, P1729, Int J Climatol	340	17
18	Parmesan C, 2006, V37, P637, Annu Rev Ecol Evol S	339	18
19	Moss RH, 2010, V463, P747, Nature	333	19
20	Thomas CD, 2004, V427, P145, Nature	329	20
21	Dee DP, 2011, V137, P553, Q J Roy Meteor Soc	301	21
22	Nemani RR, 2003, V300, P1560, Science	297	22
23	Field CB, 2014, Adaptation, And Vulnerability, Pt A: Global And Sectoral Aspects, P1, Climate Change 2014: Impacts	283	23
24	Myneni RB, 1997, V386, P698, Nature	282	24
25	Solomon S., 2007, Clim Chang 2007 Phys	281	25
26	Yao TD, 2012, V2, P663, Nat Clim Change	268	26
27	Mitchell TD, 2005, V25, P693, Int J Climatol	267	27
28	Elith J, 2006, V29, P129, Ecography	267	27
29	Root TL, 2003, V421, P57, Nature	267	27
30	Kendall M.G., 1975, Rank Correlation Met	263	30

Discussion

This quantitative scientific study of published papers dealing with climate change in the BRICS countries provides several quantitative data: the development of overall publication output of climate change research and some key subfields, contributions in journals, and the relative importance of specific research topics.The BRICS nations now came for collaboration to battle climate change through a progression of joint objectives; for example, BRICS

delegates gave a joint explanation containing the goals at the sixteenth BRICS Ministerial Meeting on Climate Change. BRICS should address these G20 culmination needs by consenting to make and advance the strides deductively known for environmental change. The range of published evidence indicates that the net damage costs of climate change are likely to increase significantly over the period. BRICS focused on climate change, which resulted in 88.6% of articles. The total number of papers dealing with climate change shows a substantial increase: Between 1991 to 2010, the number of climate change papers increased by a factor of ten and exhibited a doubling every 5–6 years. (Haunschild et al., 2016).

The present study dealt with climate change among BRICS, contributed by multiple authors. The numerous authorship pattern is further analyzed to shed more light on the practice of collaboration (Sudhakar & Thanuskodi, 2020). The climate change in Tanzania from 2006 to 2016 shows a common research trend. Single authors have produced only 99 (31%) publications, and the rest (68.9%) have been jointly authored by two or more authors (Lukwale & Sife, 2017). multi-authored articles, which indicate the collaborative research trend in climate change. (Sangam & Savitha 2019). Climate Change research Maximum (423) papers are published in Current Science, followed by the Journal of Agrometeorology with 99 publications. (Alex, Kumar & Kishore, 2019). It is understood that PLOS One published 581 documents, and 30.6% of the article published with the keyword climate change.(Li, Wang & Ho, 2011)considered assessing the worldwide publications of climate change research from 1992 to 2009. Articles related to climate change were surveyed. It was inferred that the factors such as temperature, climate, precipitation, and ozone-harming substance, will be the attention of environmental change research. Among the BRICS, the People's Republic of China contributed 17670 records. The USA is the highest number of publications, with 10110 (31.36%), whereas the UK is the second highest with 4321 (13.40 %), and the USA dominated with the highest number of publications (Sangam & Savitha 2019).

The exponential growth of climate change literature is possibly induced by the increasing influence of the IPCC Assessment Reports, which underlined the risks of global warming and eventually made climate change research an emerging topic. These reports revealed the vital need for further research for a better understanding of the earth's climate system and improved predictions of the future climate. Our findings are in rough accordance with (Grieneisen & Zhang, 2011), who reported that the number of publications on climate change and global warming had doubled approximately every four years. In contrast, (Stanhill, 2001) found a doubling rate of 11 years. But his publication set is based only on the abstract journal of the American Meteorological Society from the (earlier) time period 1951–1997. The present study revealed the exponential growth rate of climate change research. It is noticed that 3.31 was a high level of EGR in 1995, and 2.2 was caught in 2008. A lesser level of exponential growth rate was seen in 2009 as 0.7.

The research mirrored that the BRICS occupied with the execution of the Paris Agreement on environmental change, including the guideline of regular however separated duties and particular abilities, and inclination created nations to give monetary, innovative, and limit building backing to non-industrial countries to improve their relief and transformation capacities dependent on the exploration viewpoints.

Climate change is a Global challenge, so all the countries should increase research and create awareness, and also allot the fund to the researchers who could be involved in upcoming areas of knowledge. The mainstream climate change impact parameters such as temperature,

wind, humidity, clouds, and precipitation, we consider an extensive set of climate or weather extreme indices that could shed light on the possible relationships between environmental degradation parameters and induced the present study, which explored that only a few parameters are being focused targeted, rest of the parameters are being ignored such equal concern or even similar focus must be given to all parameters relevant to climate change. Otherwise, it is not easy to balance the earth or globe. All the continents must be involved to their best level to produce the research results related to climate change parameters. There would be an exception due to financial constraints, educational attainment political stability. All the continents should have more concentration on all the parameters. The funding agencies provide more funds to the causes of climate change and research fields. The outcome of the research it should be taken to the government, and a solution should be found. This should be followed not only by BRICS countries but also by all countries.

Just as the global community has tried to reduce the spread of covid19, efforts should be made worldwide to mitigate climate change.

Conclusion

The worldwide atmosphere is extended to keep changing over this century and past. The extent of environmental change past the following, not many years, relies on the measure of warmth-catching gases produced internationally and how delicate the Earth's atmosphere is to those emanations. The scope of distributed proof demonstrates that the net harm expenses of environmental change will probably be critical and increment over the long run. The significance of the support of Brazil, Russia, India, China, and South Africa (BRICS) in a worldwide environmental change system has been perceived for quite a while. The research stated that exploration distributions of BRICS have taken for agreeing to global environmental change records. They show that worldwide environmental change activity can't be fruitful without BRICS nations' contribution. BRICS should, in this manner, put forth sufficient attempts in outflows to decrease measures and critical responsibilities concerning the worldwide environmental change system.

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