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Scientific Communication on Gender Equality and Women's Empowerment in BRICS Countries: A Computational Scientometric Analysis

Bwsrang Basumatary[1], Mayank Yuvaraj[2], Nordiana Mohd Nordin[3], Manoj Kumar Verma[4]

[1,4] Mizoram University, [2] Central University of South Bihar, [3] Universiti Teknologi Mara, Shah Alam Selangor

Abstract

This study aimed to assess the research growth, collaboration trends, and performance of the author, organization, and countries and to identify the trending research topics on gender equality and women empowerment research in BRICS countries. This study employed Scientometric tools to evaluate the research publications for ten years (2012-2021). A total of 1,558 bibliographic records were downloaded from the Scopus and analyzed using Microsoft Excel and Tableau statistical tools. Moreover, the network visualization and scientific mapping analysis was done using the open-source data visualization tools VOSviewer, and Biblioshiny. It was found that BRICS countries were actively involved in research on gender equality and women's empowerment in the last decade as the publication was growing by 20.45% Annual Growth Rate (AGR) and research outputs shared 16.18% of global publications. India contributed the most publications (n=683) and received the highest citations (TC=2,798), while South Africa was the most significant collaborator with different countries across the globe. The study also identified the most prolific authors, organizations, and journals based on the number of scientific publications and citations. It is indispensable to highlight that most prolific authors and organizations were affiliated with South Africa. In recent years research has been trending in topics related to women's education, women empowerment, entrepreneurship, gender equality, and sustainability. Furthermore, the study identified the most influential articles based on the citation burst. The findings of this study will benefit contemporary society, the scholarly community and other key stakeholders in the field by providing an understanding of the development and trends of research in the domain.

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Keywords: gender equality, women empowerment, research trends, authorship collaboration, network visualisation, co-citation analysis, BRICS countries

1. Introduction

Gender equality plays a vital role in women's empowerment, poverty alleviation, and inclusive economic development. It implies equal power and opportunities to gain financial independence, education, and personal development for both men and women. Likewise, women's empowerment is essential to achieving gender equality, including a woman's sense of self-worth, decision-making power, access to opportunities and resources, and control and influence over their own life (United Nations, 2021). Gender equality and empowerment of all women and girls across the globe is one of the main agendas of the United Nations, which is clearly stated in the SDG's Goal 5 (SDGS.UNO, 2021). India is an emerging nation taking various developmental agendas to promote gender equality and empower women and girls. In keeping with the United Nations Sustainable Development Goals on gender equality, the Indian government has designated ending violence against women as one of the top national goals. The Prime Minister's "Beti Bachao Beti Padhao" project, meaning "Save the Daughter and Educate the Daughter," aims to prevent gender-biased sex-selective abortions and, ensure survival & protection of the girls and provide equal opportunities and education to women in India (WCD, 2021). In addition, particular interventions on female employment, teenage girl empowerment initiatives, the "Sukanya Samridhi Yojana" for girls' prosperity, and the "Janani Suraksha Yojana" for safe motherhood intervention all contribute to India's commitment to gender equality and the achievement of Sustainable Development Goal number 4 targets (WCD, 2021; NHP.GOV.in, 2021; IN.ONE.UN.org, 2021).

Several discussions and studies have been carried out on the issue. A contribution has been made to evaluating these trends and identifying the growth trends in research on women's empowerment and equal opportunities through this study. Mapping and tracing women empowerment research and its development will enable a greater understanding of its significance, legitimacy, history, and employment prospects for women (Kumar et al., 2019). Hence, this analysis has been carried out to know the research activities on women empowerment and gender equality in the BRICS region using Scientometric tools. It measures published literature by analyzing growth, trends, productivity, citations, keywords, authorship patterns, collaboration, funding agencies Etc.

BRICS is an acronym for the world's leading emerging economies countries, Brazil, Russia, India, China, and South Africa. Its purpose is to contribute significantly to humanity's development and establish a more equitable and fair world by promoting peace, security, development, and cooperation. Participation and intense collaboration of women is vital to the development and success of this mechanism. The study is to reveal how researchers communicate about the subject and the social, conceptual, and intellectual structures of

scientific production and its growth. The findings of this study will benefit contemporary society, the scholarly community, policy planners, decision-makers, and other stakeholders in the field by providing a thorough understanding of the development and research trends in Gender Equality and Women's Empowerment in BRICS Countries. In addition, the study will encourage further research in this area and help refine established and emerging areas of research in the field.

2. Literature Review

Several studies have been conducted to evaluate research on women and gender issues in various fields using bibliometric and scientometric tools. Kumar et al. (2019) analyzed the research productivity on women empowerment based on Web of Science data. It was a specific and single analytical study approach, i.e., citation and co-citation relation evaluation. According to the study, the topic is growing exponentially, with the United States contributing the most publications globally. India and South Africa from BRICS are making significant contributions and securing their position as the top global contributing countries. Palomo et al. (2017) mainly analyzed the development of the research publications on women, peace, and security, based on Scopus data. The majority of the authors of the papers are women, and most of the studies are conducted by authors affiliated with Anglo-Saxon countries. Hence, the result could not clearly show gender equality and women empowerment in BRICS countries. Meseguer-Sánchez et al. (2020) conducted to evaluate the role of women in a family economy in the context of poverty. Based on Scopus data, the study analyzed scientific publications on the relationship between family economy and poverty. The study found that it has been growing exponentially since the 1960s, as the USA and UK have tremendously contributed to the field, and among the BRICS nations, India, South Africa, and China have made tremendous contributions. Likewise, the tourism sector is one of the largest economy-generating sectors anywhere. Women's participation in the workforce is enormous in the tourism sector. Although the sector offers excellent opportunities for empowerment and gender equality, there are gender barriers in the tourism sector as well. Thus, many pieces of research have been conducted in this field as well. Hence, a Bibliometric analysis was conducted to examine the concept of gender equality in tourism based on the Scopus database (Araújo-Vila et al., 2021). The analysis reveals that only a few journals and authors concentrate on publications on gender equality in tourism. Moreover, Priya et al. (2021) analyzed comprehensive literature based on scholarly articles indexed by Scopus during 1999-2019 to examine how scholarly research on women's empowerment has emerged over the past two decades. The results show that the analysis did not specifically focus on the interrelationship between women's empowerment and gender equality, and other related topics focused on women's agenda. The analysis identifies the most influential journals, authors, and centers of excellence shaping women's empowerment research. It also reveals the subtopics associated with women's empowerment that have gained popularity recently, and publications have been growing exponentially. USA and UK were

the top contributors globally, and two countries from BRICS, i.e., India and South Africa, were leading in the publication and held the position among the top contributor.

Furthermore, many research evaluations and systematic reviews have been carried out to assess the gender equality and empowerment of women through research publications in various fields, such as gender equality in librarianship (Tilley, 1988), the gender gap in medical research (Bendels et al., 2018), women's empowerment and food security (Aziz et al., 2022), gender and women in bioeconomy (Sanz-Hernández et al., 2022), women in neurosurgery (Shah, 2022), Gender perspectives of COVID-19 (Samal, 2022), women's empowerment in developing countries (Nahar & Mengo, 2022), Women's empowerment and family planning (Prata et al., 2017), rural mother's empowerment (Kumar & Mishra, 2022), Gender inequality in the mental health research (Gurung et al., 2021), and many more. However, no concrete evidence of research trends analysis was found concerning gender equality and women empowerment in the BRICS region. Hence, the present study was carried out to precisely analyze the research progress, trends, and social and intellectual structure of research publications and to identify the most prolific author, organization, country, and source journals in the field.

3. Objectives of the study

1. To assess the chronological growth trends of publications and forecast growth on gender equality and women empowerment research in BRICS countries
2. To identify the most prolific authors, organizations, and journals of gender equality and women empowerment research publications
3. To analyze the social and intellectual structure of gender equality and women empowerment research
4. To identify the most trending research themes on gender equality and women empowerment research
5. To identify the most influential publications of gender equality and women empowerment research

4. Data and Methodology

This study employed the Scientometric method to evaluate the scientific publications on gender equality and women empowerment in BRICS countries. Scientometric tools are useful for measuring the progress of various scientific communications (Nalimov & Mulchenko, 1971). This method is commonly used to measure the growth and trends of research productivity and evaluate various other scientific production aspects. It evaluates the research publications through two main approaches, i.e., performance measurement and scientific mapping (Donthu et al., 2021; Borgohain et al., 2021; Basumatary et al., 2022). Performance measurement aims at evaluating the activity of scientific actors and the impact of their activity.

In contrast, scientific mapping analysis monitors a scientific field to determine its (cognitive) structure, its evolution, and the main actors within it (Noyons et al., 1999). The present study analyzed the research growth and trends on gender equality and women empowerment in the BRICS countries for ten years (2012-21). Bibliographic data was extracted from the Scopus database. The data was searched by applying the query "gender equality", independent women", "empowering women", "women empowerment", "women's education", and "women power" in the "Article title, Abstract, Keywords" section (Figure 1). Through these search queries, a total number of 21,096 document results were found without limiting and refining the search. Later the search was limited by year (2012-21), Document type (Article), Source type (Journal), and Countries (Brazil, Rusian Federation, India, China, South Africa), and found 1,562 document results. The results were scrutinized one by one, and 4 documents were found out of scope and excluded from the study. Finally, 1,558 data were extracted from the database in .csv format.

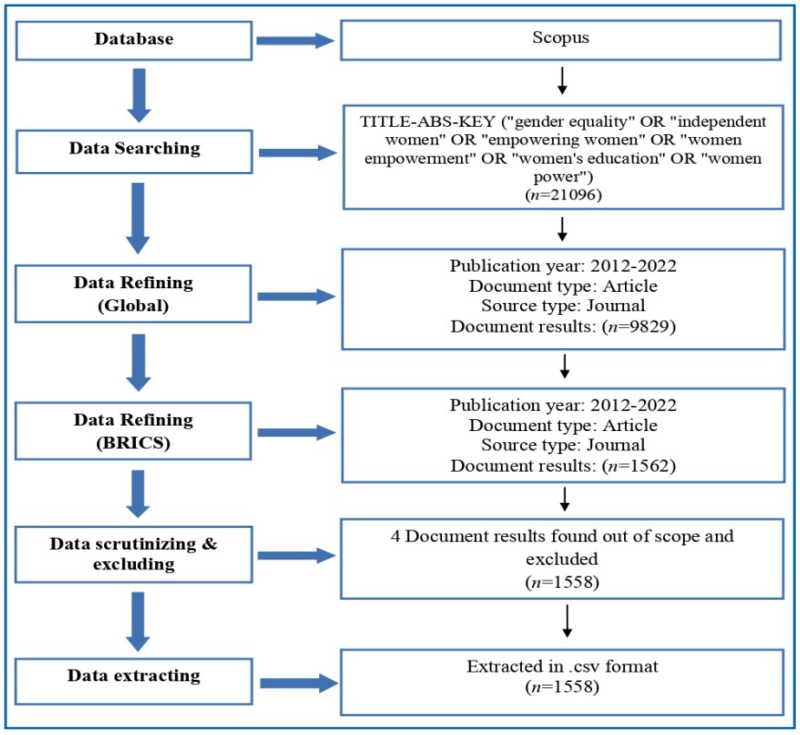

Figure 1: Workflow process of bibliographic data collection from the Scopus Database

In the search strategy, the operator "OR" was used to find one term or other related to the keyword used. It has been used because this conjunction includes all items specifically related to the searched items (Borgohain et al., 2021;

Basumatary et al., 2023a). The extracted data were analyzed using the statistical tools MS Excel and Tableau. The scientific mapping analysis and network visualization were performed using the open-source visualization tools VOSviewer and Biblioshiny software (Bibliometrix R package). Network Visualization is a powerful approach for analyzing many Scientometric networks, including citation relationships between publications, co-authorship relationships between researchers, and co-occurrence relationships between keywords (Van Eck & Waltman, 2014). Multiple software tools were used for graph preparation and visualization, depending on their features and convenience for fulfilling the study objectives. The parameters of analysis of the present study are the year-wise growth of publications, co-citation, authorship collaboration, and the geographical distribution of articles, core journals, and prominent keywords. In addition, the most influential research publications were identified based on the citation impacts.

5. Data Analysis

5.1 Publication growth trends

The line chart is applied to visualize the chronological growth trend of the publications, and R-squared (r^2) value has been included to present the growth trends of publications. The trend line seen above in the graph represents the growth of research publications at global levels and the below one represents the research growth in the BRICS countries. The trending line of global research contribution value of $r^2 = 0.990591$ (≈ 1) and the trend value of publication from BRICS, $r^2 = 0.985812$ (≈ 1) implies the consistent growth in several publications during the study period (2012-2021). Besides, the publication from BRICS grew significantly and decreased slightly in 2015. It began to rise rapidly in 2016 and accelerated notably from 2018 to 2021. It indicates that the growth of research on the empowerment of women and gender equality in the BRICS countries are growing exponentially in the last decade with 16.18% global share of publications in the field.

Moreover, the estimate of future growth and trends of the research is also forecast through the statistical analysis and interactive data visualization software tool Tableau. As per the prediction made for four consecutive years (2022 to 2025), the global research publications are expected to grow up to 2,177 (in 2022), 2,618 (in 2023), 3,149 (in 2024), and 3,787 (in 2025). Similarly, the research published in BRICS is expected to increase to 401 (in 2022), 501 (in 2023), 627 (in 2024), and 784 (in 2025).

Research growth forecasting is essential. It can help stakeholders plan for the future and make more rational decisions. For example, information professionals can plan subscriptions to forecasting journals (Armstrong, 1988; Basumatary et al., 2023b). Figure 2 clearly shows that the global research publication increased continuously.

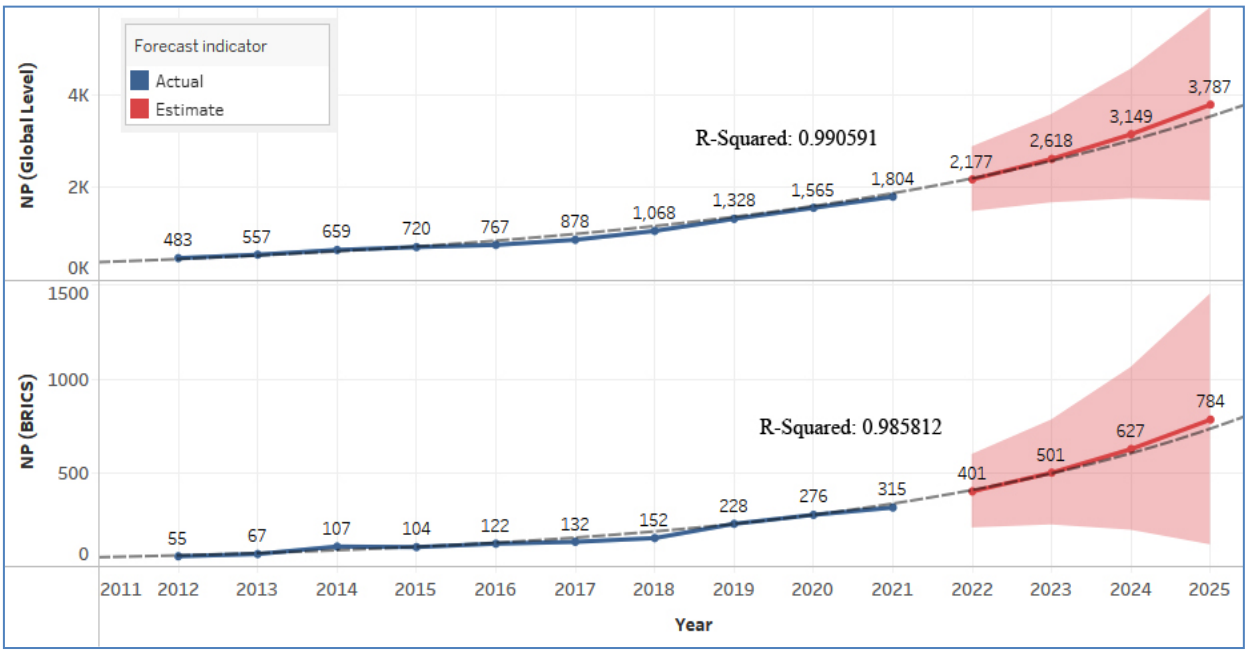

Figure 2: Year-wise growth of publication and forecast growth of research

Annual growth rate of publications

The annual growth rate of publication indicates the growth and performance of the particular subject in a certain period. Table 1 illustrates the growth rate of publications on women's studies and gender equality research between 2012 and 2021 in the BRICS countries. It has been calculated using the following formula propound by Arora & Trivedi (2012).

$$r = \frac{P1 - P0}{P0} \times 100$$

here,

r = Publication growth in percentage

p_0 = Number of publications in the base year

p_1 = Number of publications in the present year

It is seen that the publication in the domain has a positive growth rate during the study period. However, there was negative growth in the year 2015. Again the publication is accelerated from 2016 with a growth rate of 20.45%.

Table 1: Annual growth rate of publications

Sl. No.	Year of Publication	Total Number Publications	Annual Growth of Publication	Publication Growth Rate in (%)
1	2012	55	0	0
2	2013	67	12	21.81

3	2014	107	40	59.70
4	2015	104	-3	-2.80
5	2016	122	18	17.30
6	2017	132	10	8.19
7	2018	152	20	15.15
8	2019	228	76	50.00
9	2020	276	48	21.05
10	2021	315	39	14.13
				Average: 20.45%

Research contribution of BRICS countries

Along with the BRICS, 122 countries actively participated in research on women's empowerment and gender equality in the last decade. Figure 3 shows the frequency of the contribution of publications of BRICS countries. India had the most number of publications (n=683) during the study period, followed by South Africa (n=375), China (n=210), Brazil (n=191), and Russian Federation (n=131). Due to the double affiliation, change of affiliation, and collaboration, the number of publications of each country may vary from the total number of publications. The notable work done by International organizations, i.e., UNO, UNESCO, UNFPA, and other independent organizations, is impacting every country to work more on the agenda and conduct more and more research in the domain. As a result, the BRICS countries contributed more significantly to gender equality and women empowerment research during the study period than other countries. For decades, the United States and the United Kingdom were the leading countries that contributed enormously to this field. Among the top countries contributing immensely to the research activities on empowering women and equal opportunity are India, South Africa, and China (Kumar et al., 2019; Meseguer-Sánchez et al., 2020; Priya et al., 2021).

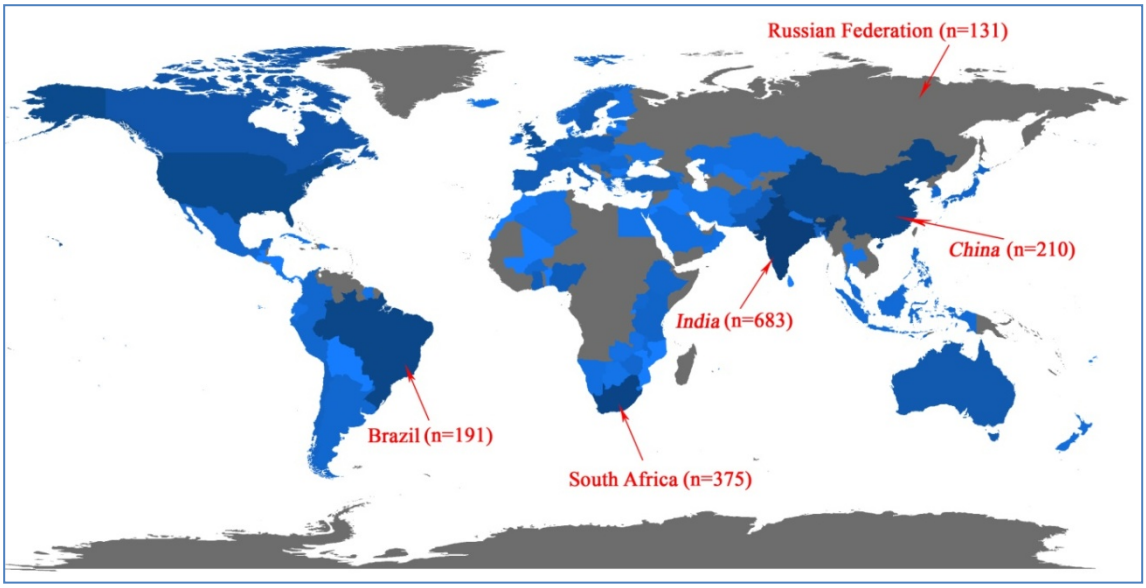

Figure 3: Research contributions of BRICS countries

5.2 Most prolific authors

Table 2 illustrates the top 10 most prolific authors of women empowerment and gender equality research in BRICS countries in the last decade. The most prolific authors have been ranked according to their total number of publications and total citations. The affiliated organization and country of the respective authors as well as h-index, g-index, and m-index are also displayed in the table.

Jewkes R topped the list of most prolific authors who primarily research the topics of Sexual Health, Intimate Partner Violence, Violence Against Women, Domestic Violence, Gender-Based Violence, and Sexual abuse. Followed by **Barros AJD**, who researched primarily on the topics of Maternal Health Services, Prenatal Care, Pregnancy, Malnutrition, Child Nutrition Disorders, Infant Mortality, Live Birth, etc. **Victora CG** was the third most productive author who worked primarily in Maternal Health Services, Prenatal Care, Pregnancy, Infant Mortality, Live Birth, etc.

The analysis found that South African authors have been more actively conducting research than any other authors from BRICS countries in the last decade. In terms of Individual country, **Rai R.K.** (Harvard T.H. Chan School of Public Health, Boston, United States), **Thangamayan S.** (Saveetha Institute of Medical and Technical Sciences, Chennai, India), **Patel N.** and **Patel R.** (Nirma University, Ahmedabad, India), etc. were the most active researchers from India. The prolific authors Jewkes, R., Gibbs, A., Peacock, D., and Odimegwu, C.O. are the leading contributor from South Africa and the BRICS. Aziz N. (Shandong University of Technology, China), He G. (Nanjing University,

China), and Wu X (NYU Shanghai, China) are the leading authors from China. As seen in the table, Barros A.J.D., Victora CG, and Ewerling F are the leading contributor from Brazil. While the Rusian Authors have not been listed in the list of prolific authors, still their contribution is significant in the field, as Shvedova N.A (Institute for US and Canadian Studies of the Russian Academy of Sciences, Moscow, Russian Federation), Khasbulatova O.A.(Ivanovo State University, Ivanovo, Russian Federation), Kostenko V.V. (HSE University, Moscow, Russian Federation), Morozov A.N. (The Institute of Legislation and Comparative Law under the Government of the Russian Federation, Moscow, Russian Federation), contributed series of researches in the field.

Table 2: Most prolific authors

Rank	Author	Organization	Country	NP	TC	h-Index	g-Index	m-ndex	PY Start
1	Jewkes R	South African Medical Research Council	South Africa	9	133	6	9	1	2017
2	Barros AJD	Universidade Federal de Pelotas	Brazil	8	300	6	8	0.75	2015
3	Victora CG	Universidade Federal de Pelotas	Brazil	8	263	6	8	0.857	2016
4	Gibbs A	South African Medical Research Council	South Africa	8	75	5	8	0.455	2012
5	Peacock D	Sonke Gender Justice	South Africa	7	347	6	7	0.545	2012
6	Odimegwu CO	University of the Witwatersrand	South Africa	6	131	5	6	0.556	2014
7	Raj A	UC San Diego School of Medicine	United States	6	58	5	6	0.714	2016
8	Patel R	Nirma University	India	6	34	4	5	0.8	2018
9	Rai RK	Harvard T.H. Chan School of Public Health	United States	5	205	5	5	0.455	2012
10	Ewerling F	Universidade Federal de Pelotas	Brazil	5	139	4	5	0.667	2017

NP=Number of publications, TC=Total Citations, PY=Publication year start

5.3 Most Prolific Organization

Table 3 depicts the ten most prolific organizations based on the publications and citations received against the total publication during the study period. The University of Kwazulu-Natal contributed the most papers (n=56, TC=267), followed by the University of the Witwatersrand (n=55, TC=547) and the University of South Africa (n=37, TC=192). South African organizations were ahead of the other BRICS countries regarding research activities in the field. However, the International Institute for Population Sciences from India was one of the top contributing organizations in the field, which carried out a series of

research on the topic of partner violence, sexual violence, women empowerment, gender differences, maternal and child health, etc.

Table 3: Most prolific organizations

Rank	Organization	Country	NP	TC
1	University of KwaZulu-Natal	South Africa	56	267
2	University of the Witwatersrand, Johannesburg	South Africa	55	547
3	University of South Africa	South Africa	37	192
4	University of Johannesburg	South Africa	36	378
5	University of Cape Town	South Africa	35	427
6	North-West University	South Africa	33	118
7	University of Pretoria	South Africa	32	249
8	University of the Western Cape	South Africa	28	319
9	International Institute for Population Sciences	India	25	269
10	South African Medical Research Council	South Africa	24	346

NP=Number of publications, TC=Total Citations

5.4 Most prolific journals

Table 4 lists the leading source titles of the research publications on women's empowerment and gender equality. The journal *Woman in Russian Society* had the highest publication records of the series of publications on topics such as gender equality, women empowerment, women's movement, women's rights, etc. The journal *Agenda* was among the leading journals in the field that published a series of articles on women's economic empowerment, women in nation-building, gender equality/inequality, violence against women, etc. *Journal of International Women's Studies* contributed significant article publications on women's economic empowerment, social empowerment, feminist activism, women in education, Sustainable women's entrepreneurship, gender equality, etc. However, it was found that the scholarly journals with high impacts were not on the list of most prolific journals except for a few titles, i.e., PLOS One, Sustainability (Switzerland), and BMC Public Health. The reason may be that the researcher did not prefer to publish their work in high-impact journals. In addition, among the ten most prolific journals, *Agenda* and *Mediterranean Journal of Social Sciences* are not found indexed in the Scopus database at present. Hence, we could not make available the details of CiteScore for these two journals.

Table 4: Most prolific journals

Rank	Sources	Publisher	CiteScore (2021)	NP	TC	h-index
1	Woman in Russian Society	Ivanovo State University Publishing	0.5	38	23	3
2	Agenda	Routledge Journals, Taylor & Francis Ltd.	NA	25	44	5
3	Journal of International Women's Studies	Bridgewater State College	0.5	22	39	4
4	PLOS One	Public Library of Science	5.6	21	284	11
5	Sustainability (Switzerland)	MDPI	5.0	18		
6	Journal of Advanced Research in Dynamical and Control Systems	Institute of Advanced Scientific Research	0.4	15	9	2
7	Revista Estudos Feministas	Universidade Federal de Santa Catarina	0.5	14	16	2
8	Indian Journal of Gender Studies	SAGE	0.9	13	40	4
9	BMC Public Health	Springer Nature	4.9	12	101	6
10	Mediterranean Journal of Social Sciences	MCSER-Mediterranean Center of Social and Educational research	NA	12	15	3

NP=Number of publications, TC=Total Citations

5.5 Social structure analysis

The social structure of the research publication can be determined by analyzing the collaboration networks between the authors, organizations, and countries (Akpan 2020; Su et al. 2021; Basumatary et al. 2022). That reveals the strength of co-authorship for the researcher collaborates to achieve common or compatible goals better, making research more quality and impactful. The co-authorship of papers stems from the researchers' desire to increase their scientific productivity, both in quality and quantity (Beattie & Goodacre, 2004; Clark et al., 2006). Further, it helps a researcher identify the subject experts and collaborators for future research on similar topics. This study analyzes the co-authorship of authors, organizations, and countries to determine how the authors from different geographical regions had been socially associated with each other and conducted joint research on various topics.

Authorship collaboration

A number of 4,263 authors were found in the data set of 1,558 scholarly publications on gender equality and women empowerment. The authors with at least 2 publications were considered for the analysis. It is found that 411 authors had an extensive set of connections in the research collaboration network, represented with the circle nodes as given in **Figure 4.** These authors are grouped into 159 colored clusters according to their research area of collaboration. Authors in a common cluster imply that the authors have worked in a similar field and have close cooperation with one another. The size of nodes

represents the total documents publications. The bigger node represents the more number of publications, and the small node represents the lower number of publications. Among the 408 authors, **Jewkes R** was the most active collaborator with 9 publications (*n*), 133 total citations (TC), and 18 total link strengths (TLS) of collaboration, followed by **Gibbs A** with (*n*=8, TC=75, TLS=17), and **Barros AJD** with (*n*=8, TC=300, TLS=16).

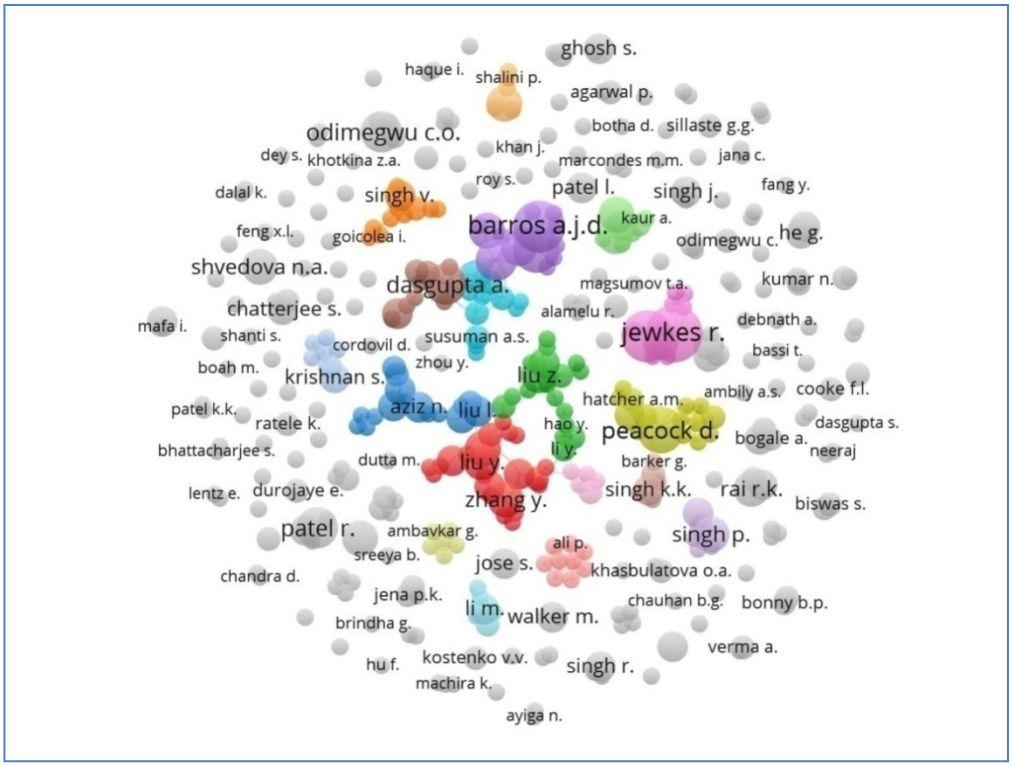

Figure 4: Authorship collaboration network

Degree of authorship collaboration (D_c)

The degree of collaboration determines the ratio of the number of collaborative research publications in a particular field in a certain period. It is calculated to measure the number of single-authored and multi-authored research publications in a particular field of knowledge. The degree of collaboration on women empowerment and gender equality research in BRICS countries during 2012-2021 was calculated using the formula propounded by K. Subramanyam (Subramanyam, 1983).

$$D_c = \frac{N_m}{N_m + N_s}$$

where, D_c = Degree of collaboration
N_m = Number of multi-authored publication
N_s = Number of single authored publication
Here,

$$D_c = \frac{1155}{1155 + 403}$$

= 0.74

The degree of collaboration in the research during the study period was 0.74. When the D_c is between 0 and 1, it indicates that the publications are multi-authored and single-authored. When all publications are single-authored, D_c will be 0 and 1 when all the publications are muti-authored. This study found that the more scientific publications on gender equality and women empowerment were the significantly high collaboration of studies.

Collaboration of countries

A total of 118 countries actively participated in research publications on gender equality and women empowerment, including the BRICS nations. Countries with at least 2 collaboration publications have been selected for the analysis and visualization. A total of 71 countries with extensive collaboration records are found in the network of VOSviewer (Figure 5). The collaborated countries formed eleven different colored clusters. Countries with similar colors represent a common cluster. Clusters are formed by the frequency of co-occurring terms representing each country. The more often the terms tend to co-occur they get colored into clusters. The size of the circles represents the number of publications in the country, and the thickness of the lines depicts the size of the collaboration. For example, the collaboration link strength between South Africa and other countries was 243. It represents that, in terms of total link strengths (TLS), South Africa was the most active collaborator, followed by India with (TLS=200), China (TLS=181), Brazil (TLS=118), and Rusian Federation (TLS=55). In addition, the country collaboration map shows that BRICS countries have extensive collaborative relations with other countries worldwide. Notably, the United States, United Kingdom, Canada, Germany, Australia, etc., are the countries that conducted a series of research collaborating with BRICS countries. It indicates that these countries were leading as research centers on gender equality and women empowerment in the last decade.

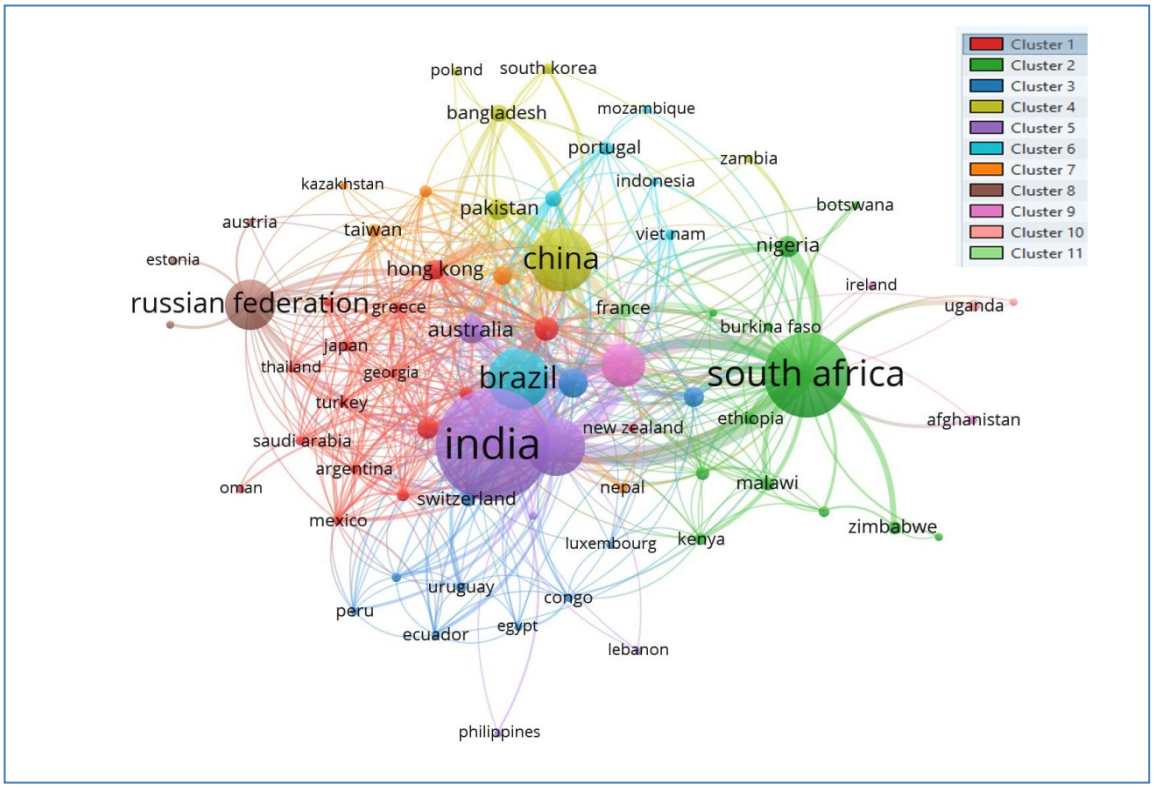

Figure 5: Authorship collaboration networks of countries

5.6 Intellectual structure analysis

The intellectual structure of scholarly publications can be identified, traced, and visualized by counting the frequency with which an author's work is co-cited with another author in the references of citing documents (Bayer et al., 1990). The co-citation analysis aids in the exploration of the intellectual linkages between the influential articles in a discipline and the mapping of the intellectual structure of the discipline (Calabretta et al., 2011; Culnan, 1987; White & Griffith, 1981; White & McCain, 1998; Basumatary et al., 2023b). A *co-citation* is a frequency with which two units are cited together (Small, 1973). Co-citation analysis can help map the intellectual structure of a research field and identify the most active research areas, discover front-line research, and bring out high-impact transformative discoveries.

In this study, authors with a minimum of 15 citations are considered to visualize a co-citation network, and out of 63,113 cited authors, 463 are found in the threshold in the visualization tool VOSviewer (Figure 6). These are grouped into 5 clusters of different colors. The highest numbers of 138 authors are in

Cluster 1, where Zhang Y, Wu X, Glick P, and Liu Y were the leading cited authors, followed by Cluster 2 with 108 authors, where Kabeer N, Sen A, Malhotra A, Schuler SR were the leading cited authors, and Cluster 3 with 93 authors where Jewkes R, Morrell R, Heise L, Peacock D, etc. authors were most frequently cited authors, Cluster 4 with 70 authors, where Jejeebhoy SJ, Singh S, Victora CG, Stephenson R., etc. were the leading authors that are frequently co cited in various scholarly papers. The last cluster, 5, consists of 54 authors. Quisumbing AR, Alkire S, Peterman A, and Quisumbing A. were the most frequently cited in the articles on women empowerment and gender equality from this cluster.

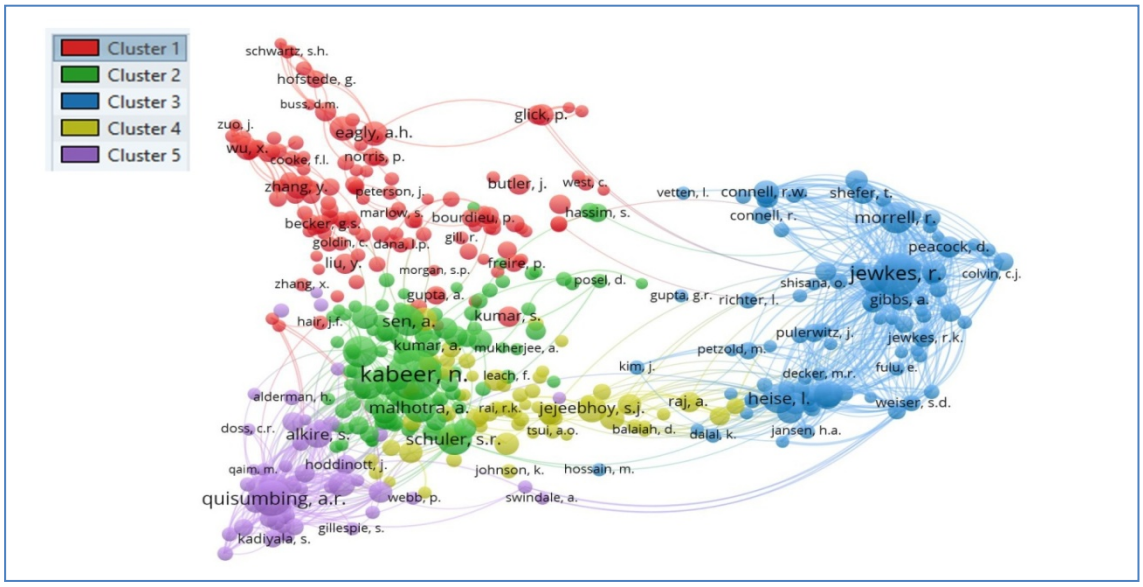

Figure 6: Co-citation networks of cited authors

Citation impacts of BRICS countries

Table 5 depicts the Citation impacts of BRICS countries. India was the most cited country with 2,798 Total Citations (TC), 26 h-index. This is followed by South Africa (2,635 TC, 28 h-index), China (1,317 TC, 21 h-index), Brazil (1,041 TC, 18 h-index), and Russian Federation (441 TC, 13 h-index) during the study period. Concerning the result, the number of publications significantly depends on the total publications by country. India has the highest number of publications, and citations were also more significant than other countries.

Table 5: Citation impacts of BRICS countries

Sl. No.	Country	TC (2012-21)	TC	h-index
1	Brazil	1,041	1,389	18
2	Rusian Federation	441	665	13
3	India	2,798	3,918	26
4	China	1,317	2,067	21
5	South Africa	2,635	3,441	28

TC=Total Citations

5.7 Analysis of trending topiccs

Figure 7 illustrates the trending research themes based on the appearances of the authors' keywords in the research publications. The visualization in the Biblioshiny has set the time span as 2012 – 2021, word minimum frequency as 2, and the number of words per year as 5. The circular nodes in the figure represent the frequency of the appearance of keywords, and the straight line represents the appearance over the year.

The figure clearly shows that in the beginning, the research focused on topics related to microbicides, prevention, HIV prevention, etc., that mainly appeared between 2012 and 2013. From 2014 to 2015, the primary topics of the researchers focused on contraceptives, community, maternal mortality, millennium development goals, gender relation, family planning, etc. From 2016 to 2017, the researchers attempted to explore various topics related to the self-help group, HIV, contraceptive use, religion, women's education, food security, men, masculinities, health, development, etc. Between 2018-19 the topics of education, microfinance, women, gender, women's empowerment, etc., are the most common topics of the researcher. In recent years, between 2010 and 2021, the studies were primarily focused on higher education, partner violence, entrepreneurship, gender equality, intersectionality, gender bias, gender gap, sustainability, etc. The evolution of the keywords shown in the figure sheds light on the research focused on various topics. Regarding the number of the appearance of the keyword, "gender equality" was the researcher's most focused topic 184 times, followed by "women empowerment," which appeared 168 times. It is seen that the recent trend of the research topics was primarily focused on education, women empowerment, entrepreneurship, gender equality, and sustainability.

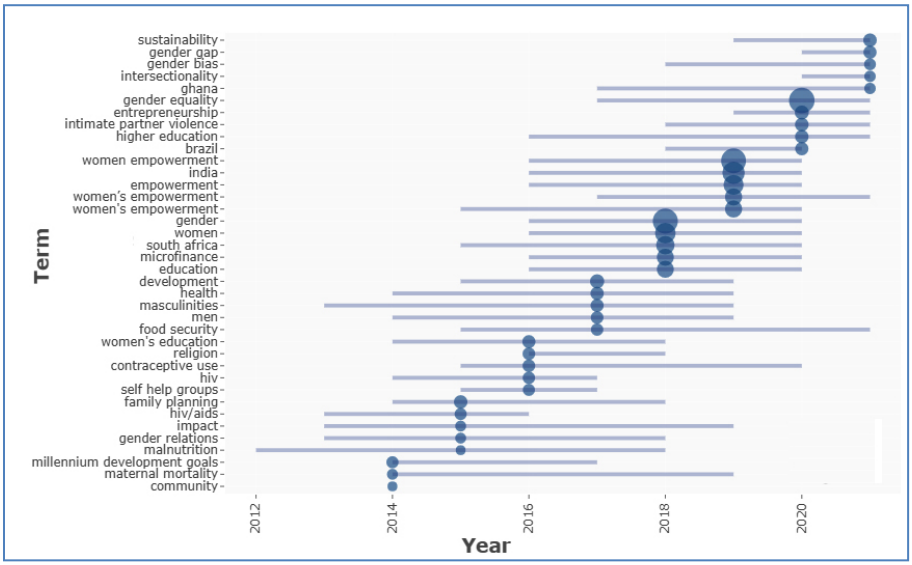

Figure 7: Trending research topics over the year

5.8 Most influential publications

Table 6 demonstrates the top 10 most influential research articles on gender equality and women empowerment in BRICS countries as indexed in the Scopus database. Articles with at least 93 citations are included in the table. These articles received 1,272 citations (11.76% share of total citations). The results reveal that the highly impactful article was "The Impact of Microfinance in Sub-Saharan Africa: A Systematic Review of the Evidence," published in 2012 by van Rooyen C., Stewart R., de Wet T., which received 254 citations (2.34% share). "Factors influencing rising caesarean section rates in China between 1988 and 2008," published in 2012 by Feng X.L., Xu L., Guo Y., Ronsmans C. ranked second among the top ten impactful articles with 175 citations (1.61% share), and "State wise analysis of microfinance sector in India" published in 2016 by Pavithra J., Ganesan M., Brindha G. was in the third rank with 136 citations (1.25% share), etc. as seen in Table 6.

Table 6: Most influential publications

Title	Authors	Year	Journal	TC	DOI
The Impact of Microfinance in Sub-Saharan Africa: A Systematic Review of the Evidence	van Rooyen C., Stewart R., de Wet T.	2012	World Development	254	10.1016/j.worlddev.2012.03.012
Factors influencing rising caesarean section rates in China between 1988 and 2008	Feng X.L., Xu L., Guo Y., Ronsmans C.	2012	Bulletin of the World Health Organization	175	10.2471/BLT.11.090399
State wise analysis of microfinance sector in India	Pavithra J., Ganesan M., Brindha G.	2016	International Journal of Pharmacy and	136	

			Technology		
Unequal Care, Unequal Work: Toward a more Comprehensive Understanding of Gender Inequality in Post-Reform Urban China	Ji Y., Wu X., Sun S., He G.	2017	Sex Roles	107	10.1007/s11199-017-0751-1
The SWPER index for women's empowerment in Africa: development and validation of an index based on survey data	Ewerling F., Lynch J.W., Victora C.G., van Eerdewijk A., Tyszler M., Barros A.J.D.	2017	The Lancet Global Health	105	10.1016/S2214-109X(17)30292-9
Photovoice: A Methodological Guide	Sutton-Brown C.A.	2014	Photography and Culture	103	10.2752/175145214X13999922103165
Empowering women through development aid: Evidence from a field experiment in Afghanistan	Beath A., Christia F., Enikolopov R.	2013	American Political Science Review	103	10.1017/S0003055413000270
Utilization of Maternal Health Care Services among Married Adolescent Women: Insights from the Nigeria Demographic and Health Survey, 2008	Rai R.K., Singh P.K., Singh L.	2012	Women's Health Issues	99	10.1016/j.whi.2012.05.001
Work-life balance in china? Social policy, employer strategy and individual coping mechanisms	Xiao Y., Cooke F.L.	2012	Asia Pacific Journal of Human Resources	97	10.1111/j.1744-7941.2011.00005.x
Impact of a Gender-Transformative HIV and Antiviolence Program on Gender Ideologies and Masculinities in Two Rural, South African Communities	Dworkin S.L., Hatcher A.M., Colvin C., Peacock D.	2013	Men and Masculinities	93	10.1177/1097184X12469878
Gender differences in Brazilian children's fundamental movement skill performance	Spessato B.C., Gabbard C., Valentini N., Rudisill M.	2013	Early Child Development and Care	86	10.1080/03004430.2012.689761

TC=Total Citations

6. Discussion

Based on Scientometric parameters, this study explored the research trends in gender equality and women empowerment in the BRICS countries during 2012-21. Scientometric is an established tool for scientific research evaluation that reports insightful information from research publications. Through a systematic assessment of existing studies, their intellectual structure, research hotspots, and

emerging trends can be identified to guide future research (Wang et al., 2020). It makes evidence more accessible to decision-makers, policy planners, and other stakeholders. The analysis presented an overview of the research growth and the publications' social, intellectual, and conceptual structure and highlighted the trending research topics in the domain.

The analysis of the annual growth of research indicates that the research on women empowerment and gender equality was increasing continuously with 20.45% annual growth rate. However, the publication was a negative growth in 2015. Again, it started rising in 2016 without any curve and is estimated to grow significantly in the upcoming years, as shown in **Figure 2.** BRICS countries have a significant research contribution in the field and share 16.18% of global research publications.

The analysis of prolific authors revealed that Jewkes R affiliated with the South African Medical Research Council, had a significant number of publications. Regarding citation, Peacock D., affiliated with Sonke Gender Justice, was the most influential author in the domain. The most influential authors were affiliated with South Africa, followed by Brazil, the United States, and India. Regarding the number of publications, India was the most productive country, followed by South Africa, China, Brazil, and Russian Federation. However, the research organizations affiliated with South Africa were the most productive among other BRICS countries. Likewise, the University of KwaZulu-Natal, South Africa, was the most productive organization based on the number of scientific publications. The journal Woman in Russian Society, published by Ivanovo State University Publishing, was the most productive based on the publication number. Regarding citation, the journal PLOS One was the most impactful and contributed a significant number of articles in the domain. In this particular area of research, the BRICS countries have made significant contributions over the past decade, with India and South Africa being among the top contributors globally (Kumar et al., 2019; Meseguer-Sánchez et al., 2020; Priya et al., 2021).

The social structure of the research publications was performed by analyzing the collaboration networks between the authors and countries. The co-authorship network of the authors is visualized to examine the involvement in which two or more researchers jointly conducted their research on the same topic, which gives us a visual understanding of the authors' collaboration with other authors. Listing the results of most collaborative authors may be helpful to other researchers for further collaborative research initiatives. As a result, **Jewkes R** from the South African Medical Research Council was the most collaborative author, followed by **Gibbs A** from the same organization and **Barros AJD** from Universidade Federal de Pelotas, Brazil (Table 2). Apart from that, the other authors also significantly conducted a series of joint research in the field, which can be seen in Figure 4, and proved that the Dc during the study period was high (Dc=0.74). South Africa was the most collaborative country among the other

BRICS countries, followed by India, China, Brazil, and Russian Federation. Additionally, the country collaboration map shows that BRICS countries have extensive collaborative relations with other countries worldwide. Especially with the United States, United Kingdom, Canada, Germany, Australia, etc.

The intellectual structure of the research publication was evaluated based on the co-citation analysis. In this study, we analyzed the co-citation of cited authors and presented it in Figure 6. As the Scientometric study is useful for science policy-making, keyword analysis plays a pivotal role in identifying trending research topics based on the occurrence of the keywords in the research articles. Analysis of trending topics in a discipline reveals recent issues and gives an insight into the keywords that were prominent in the past. The analysis revealed that the keywords education, women empowerment, entrepreneurship, gender equality, sustainability, etc., are the most frequently used recent keywords (Figure 7). It signifies that recent research was trending on these particular topics. This study identified the most influential articles based on citation impacts and presented them in Table 6.

7. Conclusion

Scientific publications are increasing in the field tremendously in the BRICS region. Because of the outstanding growth of research in the domain, a time-to-time evaluation of research progress, its characteristics, collaboration, and social and intellectual structure is necessary. The research evaluation in this area is still in its infancy. There is a lack of factual knowledge that can systematically present the current state-of-the-art work on the domain. Hence, this study was conducted to report the research progress, authorship collaboration status, and intellectual structure and identify the most influential articles, prolific authors, organizations, and trending research topics in the last decade. It is necessary to mention that there are still some avenues for further research on this topic. Multiple tools and databases are now available for obtaining and analyzing bibliographic data for Scientometric studies. The present study is restricted to the Scopus database, and only journal article was considered for analysis. Future research can be conducted by retrieving more comprehensive data from other databases like WoS, Dimensions, Google Scholar, etc., applying different search terms, and covering all documents in diverse languages.

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