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African Journal of Gender, Society and Development
Published consistently since 2012
ISSN: 2634-3614 E-ISSN: 2634-3622

Indexed by IBSS, EBSCO, COPERNICUS, ProQuest, ERIH PLUS, SABINET and J-Gate.

Volume 13 Number 3, September, 2024

Pp 223-248

A Bibliometric Analysis on Women Empowerment for Sustainable Development

DOI: https://doi.org/10.31920/2634-3622/2024/v13n3a11

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Abstract

The adoption of the Sustainable Development Goals (SDGs) in 2015 called for global implementation by all stakeholders involved. Some of the measures put in place to address the SDGs were directly or indirectly affected by the COVID-19 pandemic. The researcher conducted a bibliometric analysis. The researcher retrieved the data from the Scopus database and analysed it using VOSviewer. This study was located within the conceptual framework of "women empowerment". The findings reveal that women are still discriminated against in relation to accessing the resources, are not involved in decision-making processes. The main question on women empowerment is, How do we achieve sustainability when operating in dysfunctional communities where "gender equity" and "gender equality" do not even exist? The study recommends conducting periodic bibliometric analysis on women and sustainable development so that emerging trends could be investigated. This would provide awareness to policymakers and researchers on the achievement of the Sustainable Development Goals.

Keywords: *Bibliometric analysis, Gender equality, Sustainable development, Sustainable Development Goals, Women empowerment*

Introduction

Studies conducted previously indicate that gender equality cannot be achieved in a single day. This means gender equality requires some effort and time. Based on women experiences globally, the literature reviewed in relation to this study shows that most of the developed and developing countries have advocated for gender equality (Denney, 2015). It is important to note that Agarwal et al. (2020) also lament the reality that women are permanently confronted with numerous deterrents than their male counterparts.

Hence, a study conducted by Leal Filho et al. (2023) affirmed the need to infuse gender issues as one of the targets of the 17 Sustainable Development Goals (SDGs) to ensure more productive outcomes and greater achievement of the SDGs. In this regard, Ojwala et al. (2024) found that barriers to women's progress were mostly associated with culture, institutional practice, and structure, which included discriminatory policies, lack of childcare facilities, limited parental leave days, inflexible working hours, work-family conflict or balance, and sexual harassment. In addition, Pervin et al. (2023) argue that prevailing norms, fixed mindsets, and societal discrimination need to be addressed for the achievement of the desired empowerment results.

Gender equality, which is SDG5, is also one of the SDGs. This bibliometric analysis was conducted to investigate global publications on women's empowerment and sustainable development. Therefore, the study was undertaken to evaluate the trends of publications and demonstrate the contributions of countries, authors, and source journals. Generally, the study's interest was in how far the SDGs are being implemented or have been achieved globally.

The main aim of this study was to find out the major trends in women's empowerment for sustainable development.

The main objectives of the study were:

1. To map out the focus on women empowerment for sustainable development.
2. To identify global trends in scientific research on women's empowerment for sustainable development.

Literature Review

The United Nations (UN) unveiled, during a meeting held in September 2015, the 2030 Agenda for achieving environmental and human prosperity, which was to be promoted through the 17 Sustainable Development Goals (SDGs). Leal Filho et al. (2023) acknowledge that SDG5— "Achieve gender equality and empower all women and girls"— reveals the United Nations' continuous efforts to ensure gender equality. Furthermore, according to Denney (2015), the inclusion of "women and girls" in SDG5's target is an acknowledgement that women of different age groups experience different forms of discrimination. As Leal Filho et al. (2023) also note, women's vulnerability to discrimination, violence, and under-representation in the business, economic, and political spheres is perpetual. Therefore, there is a need to remove socially and culturally deep-rooted attitudes for women to be considered equal to men to ensure that they determine how they live their lives to enjoy their rights and contribute fully to the development of their country (Bayeh, 2016).

Sustainable Development and Women Empowerment

Bayeh (2016) argues that sustainable development cannot be achieved without gender equality and women's empowerment. The scholar argues further that to achieve sustainability, women should be empowered and equally allowed to contribute to and benefit from all levels of development. Queisser (2016) warns about the growing consensus that traditional gender stereotypes impede progress in closing the gender gap. Accordingly, Lohani and Aburaida (2017) maintain that SDGs, which are known as Global Goals, are generally a call to action to protect the planet, eradicate poverty, and ensure that all the people enjoy prosperity and peace. As Shailaja (2000) argues, recently, sustainability, has been integrated as a rule in development programmes. This means that every developmental programme should address the objectives of sustainability such as equity issues, need, self-reliance, empowerment, economic viability, and environmental soundness.

The researcher concurs largely with Leal Filho et al. (2023) that the achievement of SDG5 (Goal 5: Gender Equality: Achieve gender equality and empower all women and girls) is a priority for the betterment of global well-being. It is important to note that Leal Filho et al. (2023) also emphasise that SDG5 is an essential human right, which is an important goal on its own, as it also constitutes a cross-cutting theme spreading over all the other 16 SDGs. Similarly, Queisser (2016) maintains that the

SDG5 aims to achieve gender equality and the empowerment of all women and girls. Hence, Leal Filho et al. (2023) state that it is critical that other SDGs be re-adjusted on the interactions of gender equality to achieve specific global sustainable development objectives by 2030. The scholars (Leal Filho et al., 2023) also highlight that most studies have revealed that progress on the achievement of gender equality has been slow. In the same breadth, Bayeh (2016) states that sustainable development could only be achieved if social development, economic, and environmental protection are satisfied cumulatively. The scholar also states that it is worth noting that women's economic strength is instrumental in the achievement of other pillars of sustainable development.

Women's full participation in environmental management and development is crucial for the achievement of sustainable development, as stipulated in principle 20 of the Rio Declaration (Bayeh, 2016). Hence, Vargas (2002) maintains that sustainable development integrates social, economic, and environmental protection. Progressively, Hossain et al. (2024) argue that empowering women and achieving gender equality are crucial steps in achieving inclusive and sustainable development as stipulated in the SDG5.

Conceptual Framework

Women Empowerment

This study is framed around the conceptual framework of women's empowerment. Oparaocha and Dutta (2011) maintain that women's empowerment and gender equality have been, from 2000, regarded as key drivers for the achievement of the sustainable development goals, which were known as the Millennium Development Goals. As Moyo and Francis (2010) also note, women's empowerment was identified as an important strategy to redress gender imbalances between women and men and eradicate poverty among women.

Empowerment refers to a "multi-dimensional social process that assists people in gaining control over their lives" (Bayeh, 2016; Lohani & Aburaida, 2017). According to Bayeh (2016), women's empowerment is about allowing and equipping women to make life-determining choices on various issues in their country. On the other hand, Van Driel (2004, p.49) defines empowerment as a process that involves acting against unfair, unequal, discriminatory, and oppressive situations and recognising the interconnectedness of the personal, collective, institutional, and

cultural elements. Van Driel (2004) also warns that empowerment cannot be bestowed on people; hence, according to Adjei (2015), empowerment involves a process of change—from disempowerment to empowerment within a particular context or domain. Conversely, Mishra (2014) maintains that empowerment requires that women exercise full participation in the decision-making process in all walks of life and full participation with men in all spheres as well as the full participation of men in finding practical and equitable solutions to issues in the family and in society.

In contrast, Moyo and Francis (2010) argue that genuine women empowerment occurs when women actively participate in setting the agenda and continually occupy the driving seat as they initiate and bring change to their situations. On the other hand, Cueva Beteta (2007) argues that empowerment is not mainly an outcome but rather a process; hence, there are elements that limit or enable it that are not considered in gender forums or policies. In this regard, Akurugu et al. (2021) maintain that empowerment is a process, which is a means to achieve an outcome, which is an end. To them (Akurugu et al., 2021), empowerment also covers some external agencies that facilitate the process that enables the agenda setting (acquiring skills), and women nurturing their own independence. Notably, Syed (2010) also argues that it might assist to treat women's empowerment as a process consisting of voice, participation, choices, awareness, and agency. In the same vein, Adjei (2015) argues that women's empowerment requires the agency and instrumentality of women to wield power in their different communities for their own welfare. Hence, this study adopted components such as power, participation, agency, right, self-worth, choices, and voice for its conceptual framework.

According to Mishra (2014), women's empowerment is crucial for the achievement of the triple goals of social justice, development, and equality. According to Akurugu et al. (2021), the term "women empowerment" refers to the recognition of women's vulnerabilities and the limited livelihood options that they have. The scholars further argue that empowerment is perceived as a solution to different social problems like violence against women, limited livelihood options, vulnerability and poverty, gendered inequality, and environmental degradation. It is for this reason that Adjei (2015) states that it is critical or significant to highlight the connectedness of women empowerment to concepts like "gender equity" and "gender equality".

Sundaram et al. (2014) argue that women's empowerment has become a subject of global discussion and that education is the only

means of achieving women's empowerment. Similarly, Ajasa and Salako (2015) point out that research has revealed that education is one of the productive development investments that countries and donor partners could make that would contribute to women's empowerment. This researcher conducted a bibliometric analysis of women's empowerment for sustainable development. The purpose was to review studies on women empowerment and sustainable development to identify focused themes and reveal progress made in publications, as well as trends in this area.

Research Methodology

This section discusses the data selection process and retrieval procedures. The researcher conducted a bibliometric analysis in line with Donthu et al.'s (2021, p. 287) criterion of employing bibliometric analysis in instances where the scope of the review is broad and when one works with a dataset too large for a manual review. The researcher decided on the database (Scopus) to use before employing a bibliometric analysis. As Sanchez et al. (2017) state, the first step when conducting a bibliometric analysis of a particular research field is to evaluate the available databases, their suitability, and the benefits of using one or another.

The researcher selected, through a strict and careful process, publications on the Scopus database covering the subject areas. Scopus is one of the bibliographic databases of multidisciplinary, scientific, and international literature, which was created by Elsevier in November 2004 and has analysed citations from 1996; hence, it provides a complete view of the entire world research production (Sánchez et al., 2017).

This study employed the science mapping technique and network analysis. Donthu et al. (2021) maintain that the techniques for science mapping simply include bibliographic coupling, co-authorship analysis, co-word analysis, citation analysis, and co-citation analysis.

Data Collection

The researcher retrieved the data from Scopus and used the Boolean "OR", "AND". The search terms that the researcher used were ("education for sustainable development" "OR" "sustainable development", "AND" "women" "OR" "females"). The search was restricted to articles in the fields of social sciences and environmental science and the year of publication was restricted to 2019 to 2023. Language was

restricted to English publications only. The search yielded 1,703 documents.

Results

Based on the refined search, the researcher found about 1,703 documents on Scopus.

Publication per Country

The analysis of publications per country, which was set with a minimum of five publications and ten citations per country, indicated that 70 countries were meeting the threshold. The set criteria of five publications and ten citations per country allowed for a clear identification of the countries that had the most publications in the subject area. Table 1 presents the top 15 of the leading countries with the most publications in sustainable development/education for sustainable development or sustainability and women. The six leading countries with publications on sustainable development and women were the United States (253 papers, 2808 citations), China (219 papers, 2709 citations), the United Kingdom (188 papers, 2450 citations), Spain (149 papers, 1363 citations), India (132 papers, 882 citations), and Australia (109 papers, 1120 citations). These figures suggest that these countries have made great contributions to the implementation and achievement of education for sustainable development, or sustainable development in their countries. After these countries were South Africa (99 papers, 755 citations), Canada (75 papers, 821 citations), Germany (66 papers, 596 citations), Italy (63 papers, 661 citations), and Nigeria (62 papers, 312 citations). It is important to note that from this data Africa is represented by South Africa, Nigeria, and Ghana. Table 1 presents the top 15 countries with five or more publications and a minimum of ten citations.

Table 1: Number of publications per country

Country	Documents	Citations
United States	253	2808
China	219	2709
United Kingdom	188	2450
Spain	149	1363
India	132	882
Australia	109	1120
South Africa	99	755
Canada	75	821
Germany	66	596
Italy	63	661
Nigeria	62	312
Ghana	50	359
Pakistan	50	352
Brazil	46	381
Netherlands	43	495

(Source: Author)

The Number of Publications per Source Journal

Table 2 shows the top 26 source journals on sustainable development or education for sustainable development and women, with at least eight articles or documents. The minimum citation for each document was restricted to at least three citations and above. This criterion was based on large amounts of data that were extracted for this study, as well as the fact that sustainable development was not a new phenomenon in research.

According to the data, two journals published the most articles on education for sustainable development or sustainable development and women. The *Sustainability Journal* (published in Switzerland), featured 235 articles (with 1,720 citations) and is at the top of the list; therefore, the journal has published more articles on sustainable development and women than any other journal. This suggests that the journal is more popular on the subject and is recognised by researchers, considering its high citation rate. This is followed by the *International Journal of Environmental Research and Public Health,* with 199 articles (and 1405 citations). Accordingly, the two journals are the most influential sources in the field of sustainable development. The rest of the sources or

journals published less than 100 articles. These are the *Science of the Total Environment*, with 40 articles (and 717 citations), the *Journal of Cleaner Production*, with 34 articles (and 941 citations), and the *Journal of Environmental Management,* with 27 articles (and 359 citations). The rest published between 25 and 8 articles.

Table 2: Number of publications per source journal

Source	Documents	Citations
Sustainability (Switzerland)	235	1720
International Journal of Environmental Research and Public Health	199	1405
Science of the Total Environment	40	717
Journal of Cleaner Production	34	941
Journal of Environmental Management	27	359
World Development	25	510
Resources, Conservation, and Recycling	23	928
Sustainable Development	20	222
ssm: Population Health	18	269
Corporate Social Responsibility and Environmental Management	16	596
Environmental Science and Pollution Research	13	91
Social Science and Medicine	13	132
Environment, Development, and Sustainability	12	28
Business Strategy and the Environment	11	548
Environmental Management	11	57
Environmental Science and Policy	11	189
Human Resources for Health	10	121
Journal of International Women's Studies	10	14
Waste Management	10	190
Children and Youth Services Review	9	55
Frontiers in Sustainable Food Systems	9	15
Geojournal	9	39
Journal of Sustainable Tourism	9	105
Environmental Monitoring and Assessment	8	106
International Health	8	39
Journal of Human Trafficking	8	12

(Source: Author)

An Analysis of Co-Authorship per Country

The researcher used the text mining tool (VOSviewer) to conduct the co-authorship analysis of research per country. The minimum number of publications or documents per country was set at a minimum of five publications per country and a minimum of ten citations. About 70 countries of the 145 countries met the threshold. Unfortunately, the United States, which seems to be leading in publications (with 253 documents), is not the highest in the link strength (269), as opposed to the United Kingdom, with a link strength of 273. However, the United States seems to be the highest in terms of citations (with 2808 citations). Unfortunately, Spain, with the most documents or publications (149) and high citations (1363), had the lowest link strength (69), when compared to other countries. Table 3 presents the top ten collaborating countries.

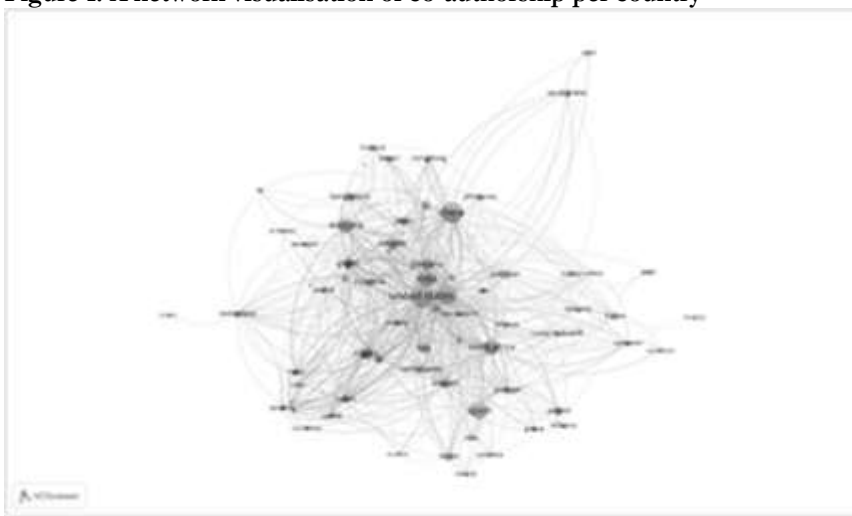
Table 3: An analysis of co-authorship per country

Country	Documents	Citations	Total link strength
United Kingdom	188	2450	273
United States	253	2808	269
China	219	2709	150
Australia	109	1120	129
Germany	66	596	102
South Africa	99	755	101
Netherlands	43	495	75
Ghana	50	359	71
Pakistan	50	352	71
Spain	149	1363	69

(Source: Author)

Figure 1 shows that countries like the United States, United Kingdom, China, Australia, Germany, and South Africa had the highest citations and collaborations (based on link strength). The figure also shows that South Africa has been and is currently collaborating with these countries with a high production rate: for example, Spain, China, the United States, and Australia.

Figure 1: A network visualisation of co-authorship per country



(Source: Author, using VOSviewer)

An Analysis of Keyword Co-Occurrence

Keyword co-occurrence suggests the research hotspots in a particular research field. In this study, the researcher used keyword analysis to identify and facilitate an understanding of the research topics and themes in the published articles. The keyword co-occurrence indicates the frequency with which a keyword appears relative to other keywords.

Donthu et al. (2021) state that unlike other techniques, the co-word analysis as a technique examines the actual content of the publication. The scholars further note that the words in a co-word analysis are derived from "author keywords", "article title", or "abstracts", and "full text". They also reveal that the co-word analysis just assumes that words that are frequently appearing together have a thematic relationship.

For this study, the minimum number of occurrences of a keyword was set at ten. Of the 10826 keywords, 497 met the threshold. However, some of the keywords were removed, as they were just the names of different countries. Table 4 shows the top 15 co-occurring keywords.

Table 4: Co-occurrence words

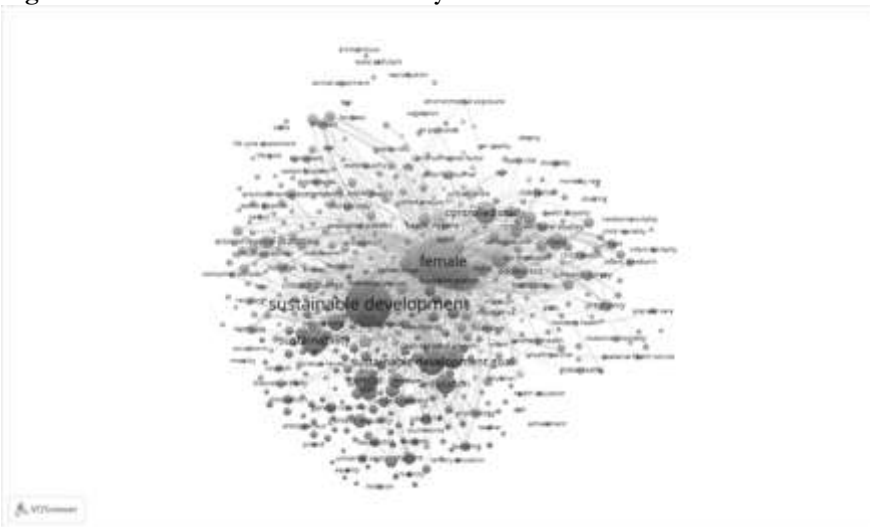
Keyword	Occurrence	Link strength
Sustainable development	888	10461
Female	589	11364
Human	552	11034
Male	458	9332
Adult	381	8003
Sustainability	290	3373
Sustainable development goal	265	3514
Gender	224	1990
Education	166	2386
Child	114	2319
Women's status	114	984
Perception	113	1776
Adolescent	101	2329
Empowerment	95	904
Public health	95	1867

(Source: Author)

According to Table 4, the most frequent keywords are "sustainable development", occurring 888 times; "female", occurring 589 times; "human", occurring 552 times; "male", occurring 458 times; "adult", occurring 381 times; "sustainability", occurring 290 times; "sustainable development goal", occurring 265 times; and "gender", occurring 224 times. The researcher used VOSviewer to generate clusters. An analysis of the cluster reveals the different research themes for each cluster. The keywords mentioned here and other keywords that met the threshold are grouped into clusters. In other words, the researcher used the word "co-occurrence analysis" to identify the major thematic clusters of this study. Figure 2 presents five major thematic clusters that can be distinguished. Clusters are represented by different colours in the network analysis of co-occurring keywords.

In the network visualisation of co-occurrence keywords, nodes represent terms or words; the bigger node means that the term or word appeared more frequently in the abstract and title of the 1703 articles that were part of this bibliometric analysis.

Figure 2: A network visualisation of keyword occurrence



(Source: Author, using VOSviewer)

Cluster 1: Gender Issues: Women Empowerment and Sustainable Development

Based on the item analysis, the first cluster contained 146 keywords that have an occurrence of ten and above. The most significant keywords in this first cluster were:

> Accessibility, capacity building, economic development, economic growth, education, education for sustainable development, educational attainment, empowerment, entrepreneurship, equality, equity, feminism, gender, discrimination, gender disparity, gender diversity, gender equality, gender equity, gender gap, gender identity, gender inequality, gender issue, gender mainstreaming, gender relation, gender role, higher education, inclusion, innovation, investment, knowledge, leadership, learning, literacy, local participation, management practice, millennium development goals, participation, participatory approach, performance assessment, policy implementation, self-concept, poverty alleviation, SDGs, social impact, social inclusion, socio-economic conditions, students, sustainability, sustainable development, teaching, technology, employment, and women empowerment.

The keywords in the cluster emphasise gender equality for global sustainable development. For instance, issues like gender discrimination, gender inequality, and the gender gap should be addressed through education or training and employment; hence, research in these areas is

crucial. Addressing these issues of concern would inform the implementation of policies to ensure the achievement of SDGs. It is noteworthy that this cluster seems to be advocating for SDG-10, "Reduce inequality"; as well as SDG 5, "gender equality".

Queisser (2016) asserts that women engage more in unpaid work for various reasons, which include the fact that some women prefer not to engage in paying jobs or prefer to do a few hours of paid job, especially when they have young children. Accordingly, Queisser (2016) argues that women who prefer to engage in more hours of paid work have difficulty balancing family and work life due to constraints like a lack of access to good quality and affordable childcare. For these reasons, Charmes and Wieringa (2003) argue that the empowerment of women is the prevalence of alternatives: hence, the term "accessibility" was one of the co-occurring keywords. This means that women do not have access to the most critical aspects of life.

Cluster 2: Managing Natural Resources

The second cluster contained 126 co-occurring keywords. The researcher removed about five keywords as they constituted the names of different countries (e.g., Brazil, Canada, Mexico, and United States). This means that only 121 co-occurring keywords fell under this cluster.
Some of the co-occurring keywords were:

> Adaptative management, alternative energy, behavioural research, biodiversity, carbon footprint, climate change, conservation of natural resources, consumption behaviour, decision making, economic and social effects, ecosystems, environmental impact, environmental management, environmental protection, environmental sustainability, family characteristics, food security, greenhouse gases, health hazards, indigenous people, integrated approach, nutrition, investment, land use, pollution exposure, quality control, risk assessment, rural development, stakeholder engagement, traditional knowledge, urban growth, urbanisation, and water.

This cluster shows a strong correlation between sustainable development and the individual's self-concept. Key concepts like consumer attitude, consumer behaviour, and consumption behaviour demonstrate how important it is for individuals to adapt to certain behaviours or lifestyles to protect the environment or preserve natural resources. This cluster also highlights the need for stakeholder engagement (using the integrated approach) to ensure environmental sustainability. Moreover, the use of

traditional knowledge from indigenous people is also re-emphasised to ensure environmental management. It is noteworthy that this cluster emphasises the importance of the "decision-making" process. As Permana et al. (2015) argue, there is a need for us to admit that women in developing countries are still marginalised and are assigned different roles in development and the decision-making process, despite men domination. Ultimately, Mishra (2014) suggests that empowering women to fight against discrimination is, therefore, necessary. In this regard, women must be empowered by ensuring that they participate in decision-making forums at all levels.

Charmes and Wieringa (2003) also assert that for women's empowerment to be realised, women must have access to resources. As Warth (2012) notes, it is mainly men who have access to power and resources. It seems that the focus of this cluster is on SDGs 1, 2, 6, 11, and 12 (i.e. "no poverty", "zero hunger", "clean water and sanitation", "sustainable cities and communities", and "responsible consumption and production" respectively).

Cluster 3: Health Issues in Developing Countries

This cluster contained 108 co-occurring keywords. The researcher removed about nine of them because they constituted the names of different countries (e.g., Cameroon, India, South Africa, Uganda). Therefore, 99 co-occurring keywords were left in cluster 3:

> Achievement, attitude to health, child health, children, cultural factors, developing countries, educational status, employment status, family planning, global health, goals, health care, health education, health knowledge, attitude, human rights, infant mortality, intimate partner violence, low-income country, malnutrition, marriage, maternal health care, migration, risk factor, rural population, religion, socio-economic factors, sub-Saharan Africa, World Health Organisation, social determinants of health, women's health, social status.

This cluster shows that health issues are crucial when addressing sustainable development. The focus of this cluster is on women and children's health: hence, there is a strong correlation between development issues and sustainable development. In other words, the socio-economic factors of an area (spatial analysis) are important to ensure that sustainable development in the developing countries of the world is achieved.

Above all, this cluster seems to emphasise the third SDG, which promotes "good health and well-being". The well-being of individuals is crucial if sustainable development goals are to be realised. The keyword "World Health Organisation" also confirmed this.

According to Warth (2012), fewer women work since they are responsible for unpaid care for the elderly and the children. In addition, the scholar has highlighted that women are always more likely to quit employment to take care of their children than men, and this is attributed to a lack of childcare facilities.

Cluster 4: The Impact of Women's Activities on The Environment

This cluster contained 59 items. The researcher removed two items from the list (i.e., Australia, Taiwan). This means that 57 co-occurring keywords were left in the cluster. Some of the co-occurring keywords are:

> Age, atmospheric pollution, environmental exposure, environmental health, greenspace, health promotion, residence characteristics, public health, urban planning, lifestyle, quality of life, schools, very elderly, and well-being.

According to Sehjpal et al. (2014), it is usually women who are expected to spend time collecting firewood and cooking. Shailaja (2000) also states that women in rural areas sell headloads of fuel wood to nearby towns; this is the only source of income for some of them. Ultimately, the degradation of some village common lands in certain areas has contributed to the decline of fuel wood sources (Shailaja, 2000). In contrast, Vargas (2002) asserts that women play an important role in advancing sustainable development: they create income-generating activities that preserve the environment.

Cluster 5: Pro-Environmental Behaviour for Sustainability

This cluster contained 58 co-occurring keywords. The researcher removed about five items from the list because they constituted the names of different countries. This means that cluster 5 had 53 co-occurring keywords. Some of the co-occurring keywords were:

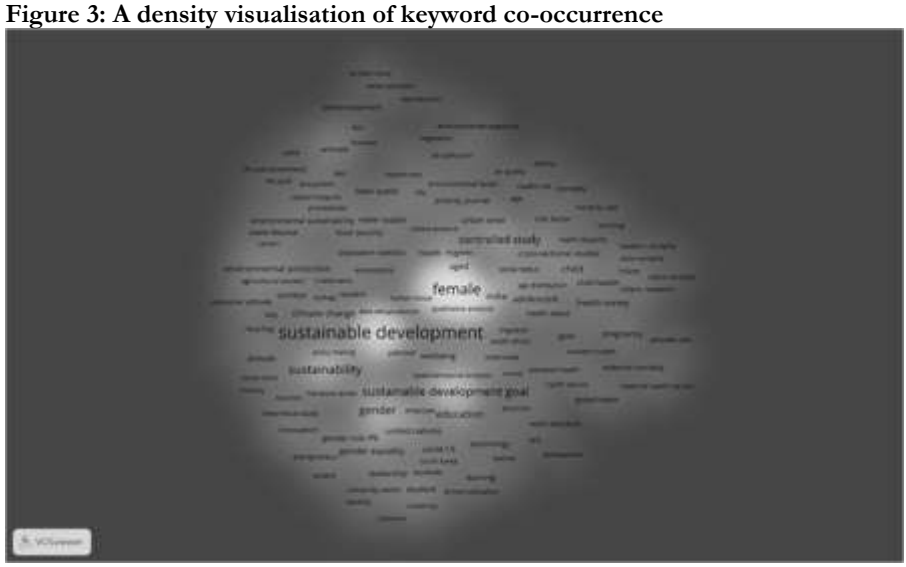
> Attitude, awareness, behaviour, behaviour change, employee, government, skill, pro-environmental behaviour, risk perception,

responsibility, satisfaction, social norm, social network, theory of planned behaviour, and waste management.

This cluster shows that attitude and behaviour are crucial for global sustainable development. Evidence suggests that sound decisions are made that benefit everyone when individuals take responsibility for their actions.

Being "aware", to a certain extent, is the first step in gaining some knowledge and skills. Moyo (2014) argues that how society perceives women, and how women perceive themselves negatively impacts their participation in issues of development. According to Aina and Olayode (2011) the relationship between poverty reduction, good governance, and gender equality at the grassroots level is crucial for long-term development. Hence, they postulate that gender-responsive governance demonstrates equality among men and women (sharing of benefits, access to resources, and participation in decision-making). Figure 3 shows a density visualisation of keyword co-occurrence.

Figure 3: A density visualisation of keyword co-occurrence



(Source: Author, using VOSviewer)

Discussion

This study sought to explore the coverage and progress on sustainable development, especially on women's empowerment and sustainability. The researcher analysed articles published in the subject area or field. This study's aim was to conduct a bibliometric analysis of articles on

sustainable development, education for sustainable development, and women's empowerment between 2019 and 2023 from the Scopus database. For purposes of this study, sources and citation of articles, co-authorship, and countries of publication, as well as the co-occurrence of keywords in the articles, were analysed to obtain more knowledge and facilitate an understanding of the implementation of SDGs (especially SDG5—Gender Equality, SDG 10—Reduce Inequalities), and to determine the emphasis thereof. Moreover, co-occurring keywords were analysed to identify and observe the research hotspots and themes that reflect the past as well as the current research focus, or directions on sustainable development.

The data shows that most journals fell within the sphere of environment or environmental issues; they were not specifically "sustainable development" journals, but rather more "environmental", although they happened to be widely known. Generally, the results suggest that some of the articles on "sustainable development" and women might be published in other highly-rated journals. In addition, the results could also reflect that journals like *Sustainability* (Switzerland) and the *International Journal of Environmental Research and Public Health* might have published considerably on trending topics like sustainable development goals, gender issues, and social justice (which are currently, burning issues globally), and there is a likelihood that these might also be topics of interest to most researchers.

Based on the data retrieved from VOSviewer, the results reflect a significantly high rate of publication (between 2019 and 2023) for different countries, as well as high citations. This relates to all countries that had a minimum of five articles and a minimum of ten citations for each article. About 70 different countries had five or more publications. This shows that the United States and China were leading, with more than 200 publications (i.e,. the US with 253 articles and 2808 citations and China with 219 articles and 2709 citations). Fortunately, South Africa was among the top ten countries at 7 (with 99 articles and 755 citations). This reflects a positive image in terms of South Africa's progress on the Sustainable Development Agenda on the African continent. Furthermore, this shows that South Africa is among the countries of the world that are advocating for the implementation and achievement of SDGs, especially those addressing gender equity and equality. The results also show that few countries had a minimum of between five and nine publications between 2019 and 2023. Therefore, this suggests that different countries of the world are engaged in dialogues and different initiatives like research to address, implement, and achieve the SDGs.

The analysis revealed that 26 journals came in at the top as they met the threshold of having eight documents and at least three citations per source. The results also show that *Sustainability,* a journal based in Switzerland, published most of the articles (between 2019 and 2023) and was the most cited journal (with 1720 citations).

The researcher analysed some co-occurring keywords to identify major thematic clusters; hence, each cluster was made of several frequently co-occurring keywords. Table 4 presents the quantitative data on the top, frequently occurring, and highly occurring keywords. It is not surprising that the word "sustainable development" had the highest occurrence and link strength value (i.e., 888, with 10461 link strength); hence, it was included in the search string, and this review itself is focused mainly on publications that relate to it (i.e., sustainable development and women). According to the keyword occurrence analysis, "female" and "human" were the second highest occurring keywords (with 589 occurrences, 11364 link strength, 552 occurrences, and 11034 link strength), respectively. Analysing the retrieved data using VOSviewer has revealed articles that cover the concepts "sustainable development" and "female", or "humans". A look at the top 15 frequently occurring keywords revealed that the following words were identified, since they also had high occurrence and link strength values. These keywords are "adult", "sustainability", "sustainable development goals", "gender", "education", "child", "women status", "adolescent", "empowerment", and "public health". From the 15 keywords, the top ten keyword occurrences were formed (i.e., irrelevant words and plural and repeated words were removed).

The top 15 co-occurring keywords reveal that the publications that were retrieved and analysed focused mainly on education for sustainable development or sustainable development, with a focus on gender issues, especially, women or humans and children's public health and empowerment. Therefore, this suggests that articles that were published around 2019 and 2023 were concerned with gender equality (i.e. SDG5). Thus, articles in different publications may have covered the perceptions of women or adolescents on sustainable development. The keyword "empowerment" had a link strength of 904: this suggests that efforts are made to empower women or adolescents on issues of sustainable development (that are more relevant in addressing gender issues). The thematic cluster that is presented by the density visualisation of keyword co-occurrence also reflected this.

Based on the Network Visualisation (VOSviewer, figure 2), Cluster 1, which is presented in "red", has 146 items or keywords. The researcher

removed about 15 words from this list as they constituted the names of different countries, and a few (four) were the plurals of other keywords. The red cluster denotes bibliometric studies that focused on gender issues, sustainable development, and women's empowerment. According to the Network Visualisation and Cluster 1, more focus was on the welfare of women—that is, addressing gender issues and ensuring women's participation, based on some behaviour change on aspects like inequality, knowledge, education, and the economy or higher education. A recent pandemic (i.e., COVID-19) was also included in the first cluster. This is not surprising, as Leal Filho et al. (2023) argue that the COVID-19 pandemic might have deepened the gender poverty gaps, which have affected women more than men. As studies have already shown, women are faced with more impediments than men.

The appearance of co-occurring keywords like "gender discrimination", "gender equality", and "gender equity" demonstrates that gender issues are critical to sustainable development. This confirms Lohani and Aburaida's (2017) assertion that gender disparity is one of the pervasive forms of inequality in the world and that sustainable development might not be achieved if actions are not taken to tackle it. Conversely, Shailaja (2000) argues that developmental programmes seldom address women's issues, even though these women make a huge contribution to the rural economy.

Cluster 2(displayed in green) was found to be more focused on environmental protection: some of the keywords included "climate change", "ecosystem", "agriculture", "carbon footprint", "carbon emission", "conservation", "food supply", "energy", "rural areas", "urbanisation", and "water". Cluster 2 shows that most publications focused on addressing the Global SDGs to conserve the environment. According to the bibliometric analyses, it seems that most articles that were published between 2019 and 2023 focused mainly on conserving resources like water, land, and all species. Hence, people/humans (i.e., consumer behaviour and attitude) are shown as important for addressing environmental policy. This also suggests some major concerns on their environmental impact on the economy (e.g., food supply versus agriculture). Ultimately, Shailaja (2000) advanced the argument that women should have access to, and control over resources, and be encouraged to participate in decisions involving technology that is meant for them in benefit sharing, resource protection, and management.

Cluster 3 (which is displayed in blue) shows that the period between 2019 and 2023 was also marked by a focus on women and children's health, referring to global health on sustainable development. Moreover,

the density overlay (clusters) and the network visualisation on sustainable development and women are interesting because both women and children's health issues were considered crucial; numerous articles have addressed these issues. This is also confirmed by the co-occurrence of the relevant keywords. Most of the co-occurring keywords concentrated for instance, on children's health (infant (newborn) mortality), healthcare, maternal care, pregnancy, and women's health. Therefore, based on Cluster 3, most publications during the period of this bibliometric analysis emphasised women's and children's health based on the stipulations of the SDGs. This means that health care promotion is emphasised. This confirms Denney (2015)'s findings that poor access to healthcare in low-income countries could spell a death threat for a young mother who is malnourished or suffers complications. Ultimately, Bayeh (2016) argues that providing the necessary care to women is critical for maintaining their health and their country's labour force. In addition, Oparaocha and Dutta (2011) have warned that "reducing child mortality" for instance, cannot be achieved without improving the household energy system.

It is important to note the appearance of the co-occurring keyword "human rights" in this cluster, which is expected. As Bayeh (2016) states, human rights are the rights of all human beings, and in addition, a "human being" refers to both genders (i.e., female and male). Accordingly, Bayeh (2016) maintains that protecting human rights is crucial to ensuring that individuals live life with dignity and for promoting development.

Cluster 4 (shown in yellow) demonstrates that the majority of publications have focused on diverse communities' socio-economic factors, population characteristics, and the impact of the environment on public health. Some of the important co-occurring keywords include "built environment", "cities", "environmental planning", "household income", "lifestyle", "very elderly", "neighbourhood", "public health", "residence characteristics", "socio-economic status", "urban planning", and "well-being". This suggests that authors who published articles that fall within this cluster were of the view that factors like socio-economic, lifestyle, quality of life, and the well-being of the elderly people were crucial to address sustainable development and women and should, therefore, not be overlooked. However, the appearance of the co-occurring keyword "age" should also not be overlooked. To this end, Denney (2015) argues that age can also impact women negatively: for instance, when young girls or women are forced into marriage. As Leal Filho et al. (2023) argue, many gaps still exist between women and men

in education, as well as politics and health across different forms of economic participation.

Cluster 5 (in purple) focused on actions taken to address sustainable development. This cluster had 52 co-occurring keywords; the researcher removed six items from this cluster. Some of these co-occurring keywords are "attitude", "awareness", "behaviour", "behaviour change", "pro-environmental behaviour", "recycling", "responsibility", "risk perception", "satisfaction", "social behaviour", "social responsibility", and "waste management". The appearance of the keywords, "behaviour", "pro-environmental behaviour", and "social behaviour" in this cluster marks a significant shift in terms of the publication's focus on sustainable development. This means that instead of being more concerned with factors impacting the environment negatively, articles focused on actions or behaviours that individuals have adopted to protect the environment. In addition, pro-environmental behaviour predicts positive "social behaviour". People in different communities perceive environmental issues as "their" challenge. Hence, they would work as a collective to address all environmental issues to achieve sustainability.

The appearance of the co-occurring keyword "male" is expected, as gender is associated with both "male" and "female". As Denney (2015) argues, some organisations have used the word "gender" as a synonym for women. Furthermore, Denney (2015) seems to concur with Shailaja (2000), who has highlighted that the concept of "gender and development", which was recently accepted, viewed women in relation to men and not in isolation. This is well phrased by Queisser (2016), who postulates that progressive gender equality is a win-win proposition, where everyone must gain from it. However, Shailaja (2000) is of the view that increasing self-confidence in women, changing the attitude of men towards women, and making them more gender-sensitive might assist in eliminating gender bias.

The study recommends that issues of gender equality should be uniformly introduced to developing and developed countries. This would assist in dealing with all the 'gender stereotypes' in different societies. Furthermore, conducting some periodic bibliometric analysis on the subject of sustainable development and women would raise awareness of the emerging trends to be investigated for the achievement of the SDGs before 2030. This would also contribute to an increase in the publications, especially on the African continent.

Limitations

One limitation worth mentioning is that the researcher retrieved the data from one database (i.e. Scopus) to conduct this bibliometric analysis. Therefore, the results might differ from other studies. In addition, the study was limited to articles published between 2019 and 2023. Furthermore, only publications in the English language were considered, meaning that there was some biasness in terms of the country distribution of publications.

Future Research

The findings of this study reveal that there are few publications or articles on sustainable development and women in Africa. There is, therefore, a need for research on Africa's priorities for sustainable development. In addition, a systematic review of African publications on gender equity and equality must be undertaken, which might also assist in closing the gap. Education is considered the most relevant tool for empowering women since it is crucial for social development. Therefore, educating women on gender issues remains a vital task in research, which should be promoted as early as during informal education, at home.

Conclusion

From the time when the Millennium Goals, which are now referred to as Sustainable Development Goals, were announced globally, sustainable development was identified and accepted as the only significant process to ensure the protection of the environment, or the entire universe. This is why, immediately after the adoption of the SDGs, vast research was published on sustainable development.

The main aim of this study was to conduct a bibliometrics analysis of this vast literature using text mining and science mapping tools. The results show that there has been scholarly progress on sustainable development literature, leading journals, countries, and themes in the research fields. Interestingly, South Africa is among the top ten leading countries in Africa that have numerous publications on sustainable development and women.

It is evident from the analysis that research on sustainable development has taken another angle; this means that there has been a shift in the focus, especially on sustainable development and women. This is further evidenced by the keywords emphasised in research:

"maternal care", "pregnancy", "women's health", "infant", "infant mortality", and "well-being". Therefore, the findings paint a picture of the perceptions of different authors on sustainable development and women and confirm that a focus on sustainable development has changed to addressing sustainable development holistically, as more focus was also on children's and women's health and population dynamics.

It is noteworthy that the findings also reveal a nexus among people, the environment, population characteristics, and human activities. Although this study was a bibliometric analysis, it is significant as it focused on sustainable development and women's empowerment, therefore, addressing SDGs—for instance, SDG3, "Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages". Other SDGs that the study addressed are SDG4 and SDG5, which are "Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", and "Gender Equality: Achieve gender equality and empower all women and girls" respectively. Last, the study addressed SDG8, "Decent Work and Economic Growth: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all".

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