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Bibliometric Analysis of Peer-Reviewed Literature on Sustainability Reports in the Context of Climate Change from 2017 to 2024

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ABSTRACT

Climate change presents a peril to worldwide sustainability. Evaluating research activities on sustainability reports in the context of climate change is crucial for policymakers and investors to provide information on environmental and business risks. This study is aimed to contribute to the literature by providing a comprehensive review of research endeavors pertaining to sustainability reports within the framework of climate change. A bibliometric methodology was applied by utilizing the Scopus database to analyze data from 2017 to 2024. The search technique employed a title/abstract search using specific keywords pertaining to sustainability reports and climate change. The search query yielded a total of 1412 documents. During the study period, there was a noticeable rise in the number of publications. The top five author keywords were sustainability, sustainability development, sustainability reporting, CSR, and climate change in the final position. The journal sustainability (Switzerland) ranked first in terms of publication productivity. However, in terms of citations, Journal of Cleaner Production is the most cited journal. In terms of collaboration, Italy has the highest percentage of documents in collaboration with international and local authors. India and UK have the highest percentage of collaboration with local and international authors, respectively. This study underlines the urgency of sustainability reporting as a benchmark for evaluating companies in addressing global issues, specifically focusing on climate change.

1. INTRODUCTION

Climate change has become a big challenge towards sustainable development, since it gives severe consequences for humanity [1]. Human activities and various industrial activities are contributing to climate change resulting in temperature increases, changes in weather patterns, and disturbances to biodiversity [2]. This phenomenon has resulted in substantial and disruptive transformations in socio-ecological systems [3]. Climate change directly or indirectly is manifested in natural climate variability over periods [4]. The notable direct negative environmental impacts include rising temperatures, fluctuations in rainfall and snowfall patterns, sea level rise, and an uptick in the frequency and intensity of weather-related disasters [5]. Since organizations and industries play a critical role in mitigating climate change, the adoption of accountability tools has become center of attention, which trigger the establishment of the potential regulation of sustainability reporting [6]. Sustainability refers to the degree to which innovations persist in usage beyond the initial implementation phase, not only when processes or outcomes have been altered, but also when there has been a shift in thinking and attitudes to endorse those alterations [7, 8].

Some research has been conducted on the relationship between climate change and sustainability, encompassing various areas such as sustainable development, innovations, and environmental consequences associated with climate change [9-16]. In terms of quantitative representation, research on climate change is primarily led by the USA, the UK, Germany, and Canada. China ranks fifth in this regard, trailed by France and Australia [17]. Corporate initiatives to address criticism through the adoption of human rights policies may be met with skepticism unless there is a rise in standardization in reporting. Bibliometric analysis indicates that out of 1009 journals examined, all have published at least one article on climate change and sustainability. And most of them, 77.40% (781 journals), have only published a single article on this topic [4]. The endeavours of companies, especially in agriculture and plantation-based industries, to adjust to the risks posed by climate change at the production, business, and stock market levels have a notable influence on investors' behaviour and investment choices [18].

Some green actions conducted by companies may not be in line with climate change mitigation in order to maintain low operational costs and high profitability [19, 20]. On the other hand, some other companies participate in emission reduction initiatives to tackle climate change [21, 22]. As depicted in Figure 1, the graph illustrates a consistent rise in annual greenhouse gas emissions worldwide from 1990 to 2022 worldwide, in response to climate change concerns, the Kyoto

Protocol was introduced in 1997 with the primary goal of reducing global emissions to mitigate the impacts of global warming [23]. The Carbon Disclosure Project (hereafter-CDP) offers voluntary recommendations for organizations to report climate-related data. The Paris Agreement, which was adopted in 2015 as a successor to the Kyoto Protocol, was intended to overcome some of the Kyoto Protocol's inadequacies by taking a more flexible, inclusive, and less binding approach [24]. This strategy enabled all countries, not just industrialized ones, to establish their own targets for decreasing greenhouse gas emissions. In contrast to the Kyoto Protocol's more rigorous and binding targets, the Paris Agreement's framework is more adjustable and invites broader participation [25, 26]. The FASB established the Task Force on Climate-Related Financial Disclosures (TCFD) to develop recommendations for more effective climate-related disclosures that could "promote more informed investment, credit, and insurance underwriting decisions" and in turn, "would enable stakeholders to understand the carbon-related assets in the financial sector and the financial system's exposures to climate-related risks" [8].

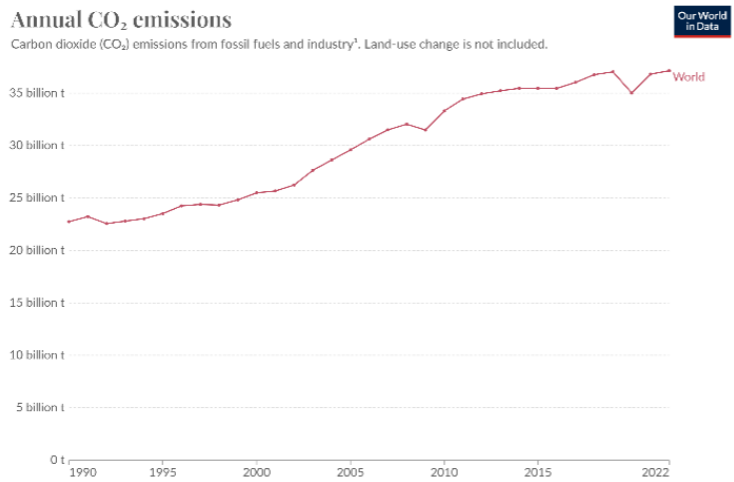

Figure 1. Annual CO_2 emission [19]

Fueled by increasing global awareness of the importance of sustainability and climate change, and the need for more consistent and transparent reporting standards, including the 2015 Paris Agreement. In 2021, the ISSB published IFRS S1 and IFRS S2 to integrate and develop the TCFD recommendations.

Climate change-related information is gaining public attention and is expected to be included in sustainability regulations [12, 27]. Sustainability reports are prepared based on one or more frameworks available, which may deteriorate their comparability [28]. One of the causes of climate-related framework is still underutilized, because TCFD framework is published in 2017 and is still being developed and IFRS S2 framework was just published in 2023. Some prior research in literature reviews and bibliometrics [4, 7, 10, 17, 29-32]. This study contributes in two ways. First, this study added literature related to climate change and sustainability and gives direction to future research in climate change and sustainability topics.

Second, we adopt a systematic literature approach to evaluate the development and implementation of sustainability policies and reporting globally [33]. The results may contribute to literature for researchers, policymakers, and professionals in selecting sustainability report frameworks that adherence to the Paris Agreement in tackling climate change.

2. CLIMATE RELATED FRAMEWORK

At the company level, climate change mitigation has become more and more of a strategic focus for some companies [1]. Climate-related transparency provides clarity on the actions taken by companies. This transparency may influence investors' decision-making to support low-carbon activities and improve the company's public image [34]. Given this, the Carbon Disclosure Project (CDP) was established in the UK as the initial endeavor to promote transparency regarding companies' efforts in addressing climate change mitigation [35]. However, this CDP framework is not popular since it has a rigid structure and organizations need more resources to implement and maintain the framework's implementation S and S2. IFRS S1 is a framework for preparing corporate sustainability accountability reports in general, while IFRS S2 is a guideline that focuses on addressing climate change issues (IFRS S2, These IFRS S1 and S2 are part of the International Financial Reporting Standards (IFRS) aimed at enhancing the transparency and consistency of climate-related financial disclosures. These frameworks are expected to encourage all public companies and financial institutions to provide information on Climate Risk Opportunity (CRO) related to governance, strategy, risk management, metrics and targets, as depicted in Figure 2.

In response to the changing environment of sustainability reporting, the ISSB developed IFRS S1 and S2, which are intended to improve the utility of financial data pertaining to sustainability. Through their attention to the requirements of comparability, transparency, regulatory compliance, and stakeholder involvement, these standards contribute to the development of a more robust and sustainable global economy. IFRS S2 adopts metrics and assessments from TCFD, with detailed criteria for quantitative and qualitative information. IFRS S2 focuses on a more specific classification of company information to explain a more detailed description, it requires disclosure of material information about the governance processes, controls and procedures that companies use to monitor, manage and oversee risks and opportunities related

to climate change seeks to bridge the gap between financial and non-financial data by mandating companies to include the additional information of mitigating climate change risks accompanying their annual reports [36]. These IFRS S1 and S2 encourage all public companies and financial institutions to provide information on Climate Risk Opportunity (CRO) related to governance, strategy, risk management, metrics and targets, as depicted in Figure 2. TCFD have different disclosures from the other Framework.

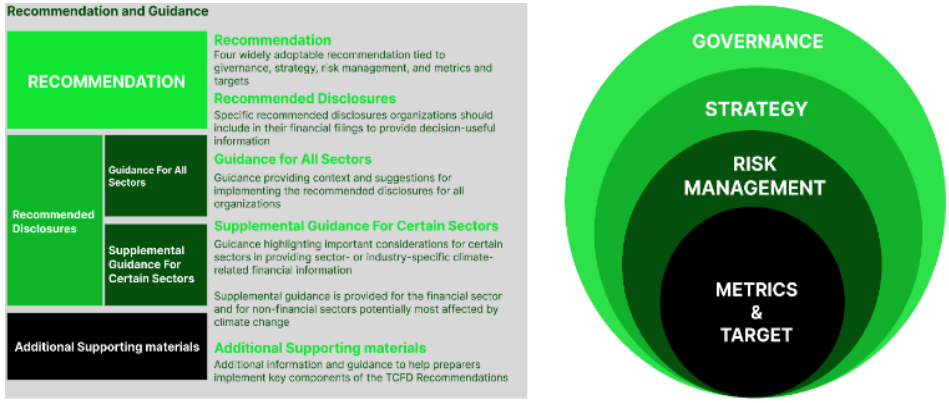

Figure 2. TCFD recommendation and guidance (2017)

3. METHODOLOGY AND LITERATURE COLLECTION

To conduct a comprehensive bibliometric study, it is essential to utilize databases with diverse structures to gather relevant documents, ensuring the completeness of the data. However, using multiple databases is practical only if the volume of literature on the topic being studied is limited. A literature review is a basic element in scientific research. The literature review methodology is developed according to various objectives as the scientific basis for future research and research gap on the scope of a research topic [37]. By summarizing, analyzing, and synthesizing specific literature, bibliometric may assess the trend and gap of existing works on a specific topic [30].

The study's primary purpose is to investigate the literature on climate change and sustainability reporting. A bibliometric technique was utilized to find relevant material, integrate it, and conduct a structured evaluation of the prior research. To design this bibliometric research, we used the Scopus database for its reputable collection paper, using the search terms sustainability OR "climate Changes" AND "Sustainability Reporting". We chose bibliometric analysis using VOSViewer software to analyze and visualize the data from Scopus-indexed papers [38]. This tool assists researchers in selecting several previous studies that are relevant to our topic. This selection was conducted with a set of certain criteria, including relevance of the topic to the research focus, year of publication, type of publication, and language of publication [39].

We filtered the search results based on predefined inclusion and exclusion criteria and removed duplicates to obtain a clean and qualified dataset. Relevant data was gathered and analyzed to identify common patterns, differences, and key conclusions of prior study findings that are relevant to our research objectives [37]. By following this process, we ensured that our bibliometric study was conducted thoroughly and comprehensively. Then, we mapped the research gaps [30] and highlighted various guidelines related to sustainability, especially in the context of climate change mitigation [40]. By understanding the topics of previous research, we can find the research gaps [30].

4. RESULT AND ANALYSIS

Figure 3 shows the annual publication records from 2018 to 2024. This data shows the trend in research volume over these years. Starting in 2018, the number of publications increased steadily. This reflects growing interest and awareness. This trend continued until 2021, when there was a slight decline. After the decline in 2021, the number of publications began to increase again in 2022. This resurgence indicates a renewed focus. There may also be increased funding or policy interest. The upward trajectory continues until 2023, reaching a peak of 350 publications. This peak is the highest number on record. It indicates a surge in scientific attention and output. Likely fueled by global concerns about climate change. Also, by the urgent need for sustainable practices. Overall, Figure 4 shows a dynamic trend in research. There are periods of growth and decline. Ultimately, this leads to a substantial increase in publications by 2023. This pattern highlights the importance and growing interest in addressing sustainability and climate change. This may be explained by the is substantial increase of transparency and many governments' implemented stricker regulations on disclosing sustainability-related initiatives. Since the GRI is the standard recommended by the United Nations, it is the most popular and is used in sustainability reports.

Figure 4 describes the analysis of the topics "climate change" and "sustainability report" using VosViewer on 1412 journals (2017-2024) from the Scopus database with the limitation that only journals using English. Keyword analysis shows that the keyword "sustainability reporting" is a topic with a high frequency of discussion and tends to correlate with many other topics, followed by the keywords "sustainability" and "corporate social responsibility". It is worth noting that the keyword "climate change" has less frequency of publication and has a relatively weaker correlation to the largest keywords in this data, indicating a gap in the discussion of this topic and exploration that links it to other topics, especially "sustainability reporting". This gap is reinforced by the different coloration of the keywords "climate change" and "sustainability reporting", indicating a lack of journals that comprehensively address both topics. Although the CSV raw

data found several literature reviews addressing sustainability reporting and climate change, this does not mean that all topics in Vos viewer are covered. Studies that lean towards sustainability reporting are limited to discussions on frameworks from the global reporting initiative (GRI), indicating that these topics tend to be more often discussed together, suggesting that research on companies following frameworks other than GRI for sustainability reporting is still rare.

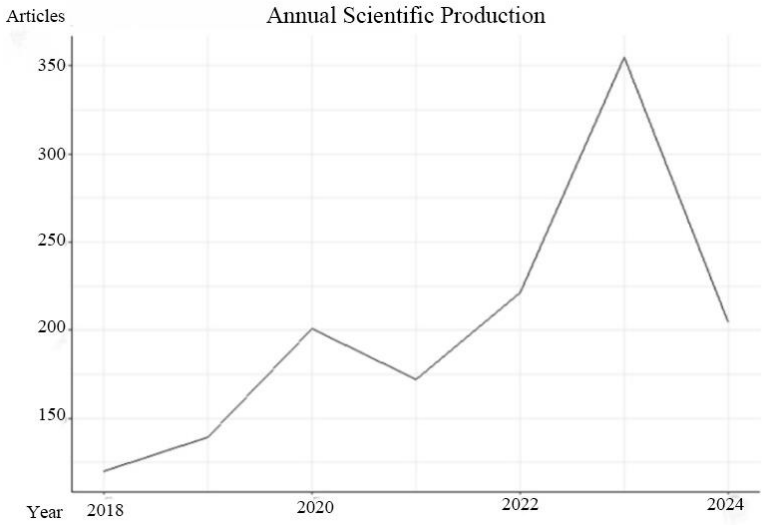

Figure 3. Annual growth scientific production

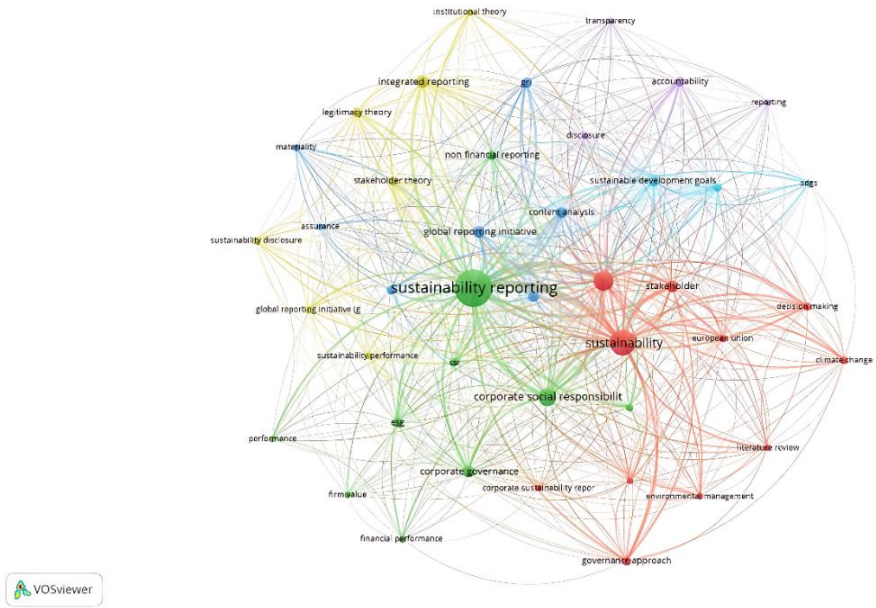

Figure 4. Co-occurrence network of author's keywords

Table 1. Top 10 most active journals

Rank*	Sources	Article
1	Sustainability (Switzerland)	139
2	SustainabilityAccounting, Management and Policy Journal	59
3	Corporate Social Responsibility and Environmental Management	52
4	Journal of Cleaner Production	45
5	Meditari Accountancy Research	41
6	Accounting, Auditing and Accountability Journal	36
7	Business Strategy and The Environment	36
8	Cogent Business and Management	21
9	Journal of Applied Accounting Research	19
10	Social Responsibility Journal	19

The ten leading journals, which actively publish articles in the field, were determined. As it appears from this list, the first position goes to "sustainability (Switzerland)", with a total of 139 publications, which makes this journal one of the significant contributors to the research in the sustainability field. next in the row is "sustainability accounting, management, and policy journal", with a publication record of 59 articles, again emphasizing its focus on the intersection between sustainability and accounting and management policies. "Corporate social responsibility and environmental management" is third with 52 articles reiterating the significance of the journal when discussing corporate social responsibility and environmental management issues. Table 1 displays the top 10 journals excluding those mentioned above.

Figure 5 explains the development of the top 5 active countries cumulative producing literature review studies over time. Here it can be seen that Australia, Indonesia, Italy, Spain, and the United Kingdom are countries that often publish literature on Sustainability reports and climate change. These five countries have a relatively consistent development in issuing articles on this topic. Italy is a country that has published 416 kinds of literature compared to the four other countries. Australia, Indonesia, Spain and the United Kingdom have published 256 papers, 241 papers, 239 papers, and 222 papers, respectively. Indonesia's development in this topic increases throughout 2022 so that it can catch up with the United Kingdom and Spain in 2024.

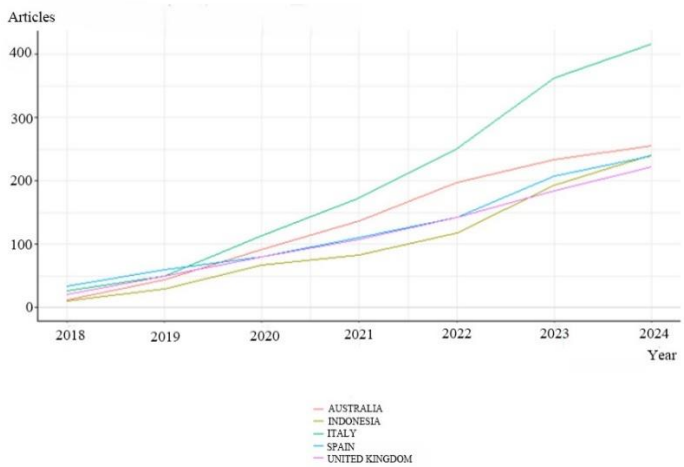

Figure 5. Top 5 active countries producing literature over time

Figure 6 shows that Universitas Airlangga is the number one ranked affiliate in research publications with Sustainability reporting and climate change, they have 39 studies related to this topic. This is indicated because Indonesia is a country that is committed to realizing the SDGs by 2030, so keywords that are often used in this research tend to be frequently used. The number of documents produced shows that Indonesia has a high interest and expectation of contributing to SDGs development research, especially on the topic of climate change and therefore there is a need for research on sustainability reporting to achieve SDGs.

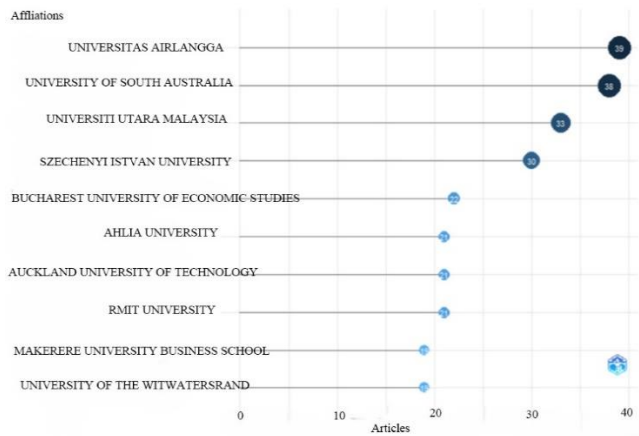

Figure 6. Most relevant affiliations

In addition, Australian universities have studied on this topic, due to their concern on sustainability initiatives and reporting that supports the implementation of the SDGs through various frameworks. Moreover, Australian universities have more resources and support to conduct research in sustainability and produce high-quality publications.

Extraction results from the Scopus database using the keywords "sustainability" or "climate changes" and "sustainability reporting" showed there were 1,412 journals relevant to the term. From the extraction results, the thematic map is shown in Figure 7. The red clusters indicate that the literature contained, is highly oriented towards the theme of sustainability or sustainable development. This cluster position indicates that the topics in the cluster are being researched in the literature and contribute to the sustainability theme. The themes discussed in the red cluster include themes regarding to sustainability, stakeholders, corporate social responsibility and climate change, which is the focus of this study.

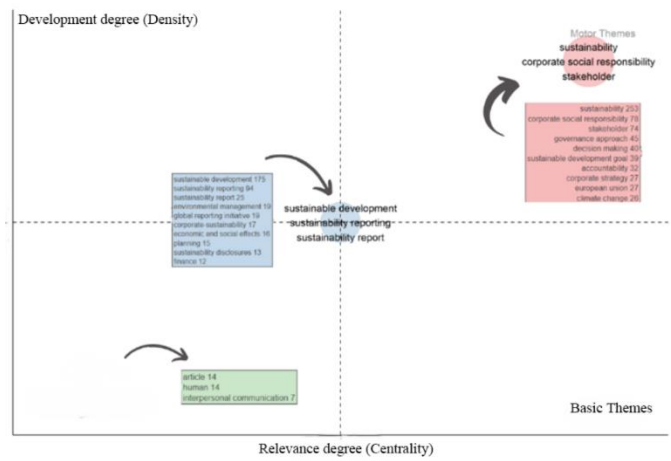

Figure 7. Thematic map

It can be seen in the figure, "climate change" topics ranks as the least topic in the sustainability cluster. This means that although the amount of climate-change-related literature is relatively less among other topics, the topic of climate change is assumed to be a contributor to the sustainability theme. The blue cluster, in the centre of the map, indicates that this topic is experiencing an increasing trend in the frequency of discussion in literature and influences research development.

Although not as frequent as the red cluster, research on the sustainability reporting theme contains interesting topics on reporting of climate change and environmental impacts. From the content of the theme, these topics support sustainability reporting topics, seen from topics such as global reporting initiatives, economic and social effects, and sustainability disclosures but have a weak trend in terms of the number of publications. These are the topics that contribute to the development of this theme.

Figure 8 shows the frequency of keywords in journal abstracts, with "sustainability" being the most dominant topic compared to other topics. This shows that "sustainability" is the main issue often discussed in the context of sustainability during 2017-2024. Therefore, it can be concluded that research on "climate change" and "sustainability reporting" has not been very specific and in-depth in its discussion. This situation allows this research to bridge the gap by providing a more in-depth and focused analysis of the relationship between climate change and sustainability reporting. With an in-depth analysis of the topic, this research can provide valuable information by examining the guidelines related to climate change and the urgency of reporting, especially regarding the relationship between TCFD and IFRS S1 and S2. As such, this research not only highlights the importance of standards such as GRI, but also provides further insight into how companies can more effectively report their impacts and efforts in dealing with climate change.

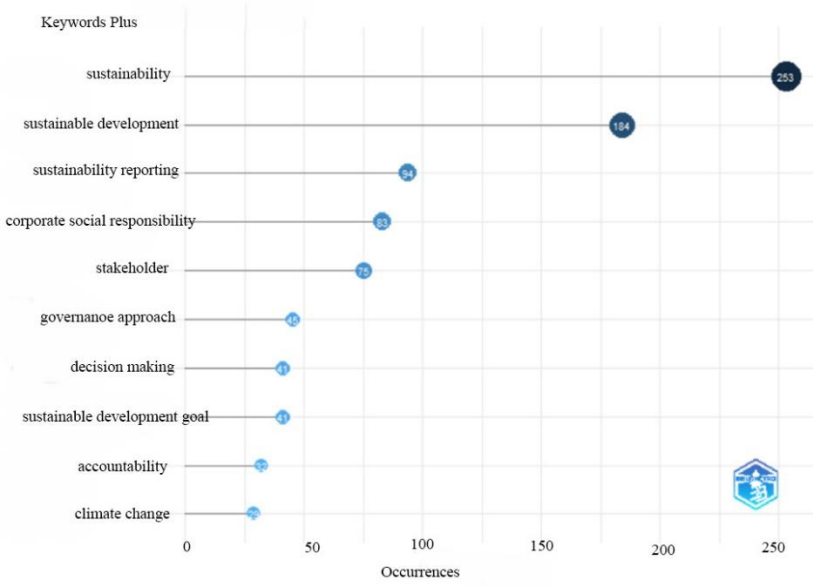

Figure 8. Most frequent words

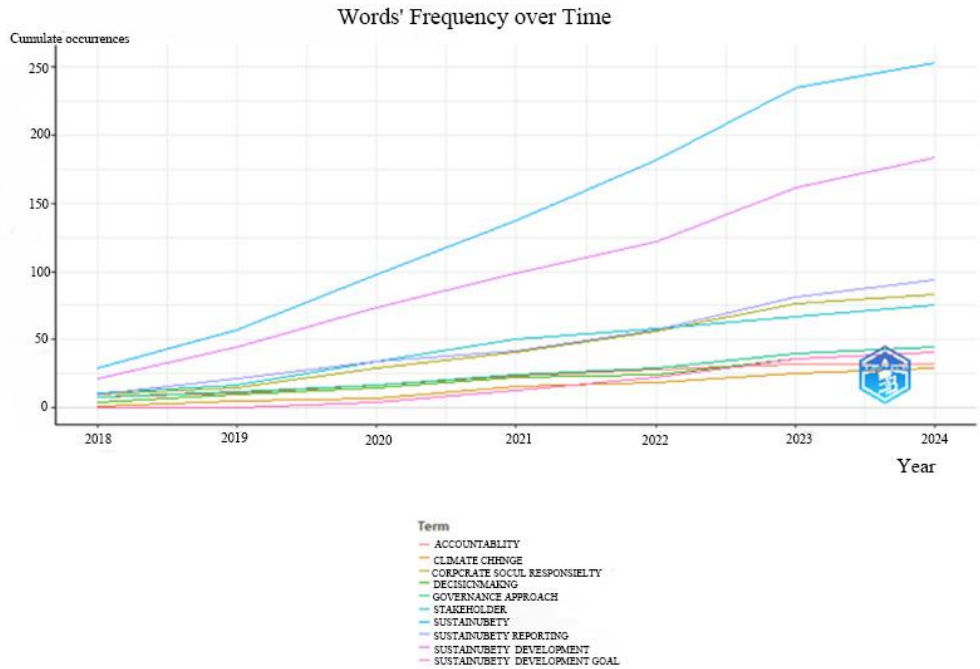

Figure 9. Words frequency over time

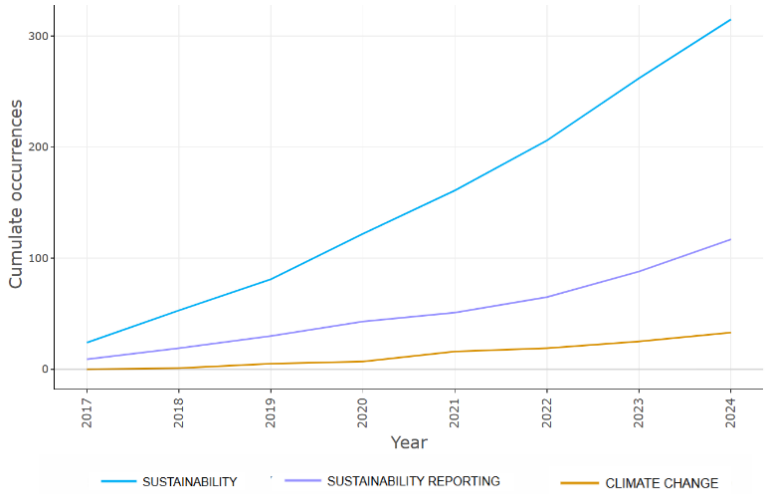

Figure 10. Trending topic of categories

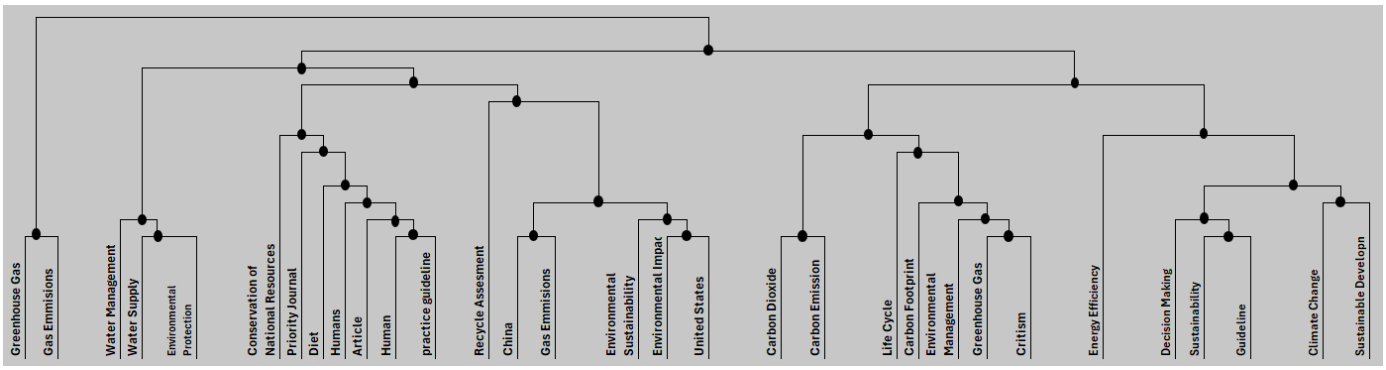

Figure 11. Tree map for term

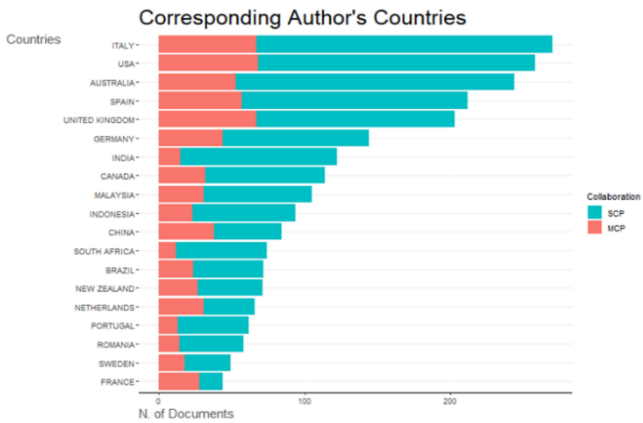

Figure 12. Multiple-country (MCP) and single-country (SCP) collaboration

The term "sustainability reporting" experienced a steady increase, indicating that it is still a relevant and frequently researched topic each year, with many studies mentioning the term in their abstracts and using it as a keyword. In contrast, although the word "climate change" has also increased, the number is not as much as "sustainability reporting", indicating that there is still a lack of attention to climate change research, especially those that relate it to sustainability reporting standards other than GRI. In addition, the lack of sustainability frameworks that appear with high frequency, frameworks such as GRI which are usually the most common frameworks still have a low occurrence, indicating that research on sustainability frameworks is underrated in the context of sustainability (Figure 9).

During period of 2013 to 2024, Figure 10 depicts Some research on "Sustainability" experienced significant growth, as seen from the graph, that continues to increase consistently. In contrast, the terms "Climate Change" and "Sustainability Reporting" also gradually increased This suggests that although there is great urgency on the topic of climate change and sustainability reporting, the development of research is more about sustainability than climate change. This may indicate that researchers may be focusing more on other dimensions of sustainability, such as green technology

innovation, sustainable management practices, or the integration of sustainability in the supply chain.

This trend also highlights the need for in-depth analysis in area of sustainability and climate change reporting. With increasing awareness and attention to global environmental issues, further research linking sustainability with sustainability and climate change reporting will be essential to build a more comprehensive and integrated framework. This study may fill that gap by providing analysis on sustainability and climate change.

As can be seen from Figure 10, several sets of words are connected to each other. Here is a detailed topic tree of the Scopus data, which outlines the relationship of each topic. The focus on the rightmost branch shows that sustainability and guideline are on the same branch. The assumption is that the focus of these two topics is to determine the company's decision making using the concept of sustainability that refers to the guideline. However, the topic of climate change is not directly connected to the guideline. This means the existing articles do not have a specific reference to the guideline specific to climate change. Thus, it appears that while there is an awareness of the importance of sustainability and related guidelines, there is still a void in the literature that specifically links climate change to clear and structured reporting guidelines (Figure 11).

The analysis of data on Figure 12 shows publications related to climate change and sustainability report reveals significant insights into the involvement of corresponding authors in single-country (SCP) and multiple-country (MCP) collaborations. The Italy stands for the highest productivity in SCP with 203 articles and ranks second in MCP with 67 articles same with United Kingdom. Highlighting its substantial focus in this research domain, the USA stands out as the leading nation in collaborations, topping the MCP list with 68 articles, and securing third place in SCP with 53 articles. Australia closely follows, ranking second in SCP with 191 articles and third in MCP with 53 articles. Interestingly, among the top ten countries, most are developed countries, with notable exceptions such as Indonesia, and Malaysia, which are developing countries. This can be explained that developed countries are supported by various research grant and significant portion of GDP to R&D in green technology advancement. In the contrary, developing countries like Indonesia and Malaysia may face limited sustainability-related research grant and number of specialized researchers. In addition, the concept of innovation ecosystems among universities, businesses, and government, is lack of attention in developing countries. Indonesia and Malaysia must give attention to this matter to improve the sustainability-related decision making.

The analysis above shows that sustainability reporting is important for companies and investors in decision-making, with guidelines such as the TCFD and IFRS playing an important role in maintaining environmental image and responsibility, especially regarding climate change. The TCFD and IFRS are developments of reporting frameworks initiated by CDP since 2000, with IFRS S2 addressing climate change following TCFD recommendations and IFRS S1 adapting GRI for general sustainability guidelines. TCFD recommendations are made mandatory in IFRS S2, binding companies to report on sustainability based on IFRS S2 metrics. The analysis shows a difference in focus between TCFD and GRI, with TCFD emphasizing the resilience of corporate strategies to climate scenarios and GRI on social, environmental and economic aspects in general. Since 2017, the TCFD recommendations have received special attention and by 2022 were endorsed by 67 countries, although not as popular as GRI, its use has received enthusiasm and positive reviews.

The adoption of sustainability guidelines such as the TCFD and IFRS S2 significantly impacts the management and reporting of climate change-related risks and opportunities. The literature points to four main impacts: increased transparency and accountability, with these guidelines encouraging disclosure of climate risk information and mitigation strategies, thereby increasing corporate accountability to stakeholders. Second, influence on investment decisions, with investors trusting companies that follow these guidelines more as they demonstrate strong strategies to deal with climate change. Third, improved corporate image, with implementation of the guidelines helping companies maintain their image as environmentally responsible entities. Lastly, improved corporate readiness and resilience, making companies better equipped to deal with the impacts of climate change and various future scenarios.

The research highlights several key findings with significant implications for companies and policymakers. Transparency and accountability increase through the adoption of TCFD and IFRS, encouraging companies to be more responsible in sustainability reporting. Better sustainability information supports more informed investment decisions. Companies that adopt sustainability guidelines tend to have a better image in the eyes of the public and investors [18]. These guidelines also help companies better prepare for future climate change-related risks and opportunities. The conclusion shows that the TCFD and IFRS promote environmental responsibility and preparedness for climate challenges, providing a strong basis for sustainability reporting research and implementation.

Overall, this bibliometric analysis indicates that while there is a gap and correlation that can explore more in the topic of sustainability and climate change, the specific aspect of framework in this context has not received significant attention. This research seeks to bridge the gap by providing an in-depth analysis of climate change-related framework and its reporting urgency, particularly on the relationship between TCFD and IFRS S1 and S2. Thus, it is expected that this research can provide comprehensive and relevant information for further development in the field of sustainability and sustainability reporting.

Figure 13 shows that the most frequently cited document is the work of Rosati F published by Cleaner Production in 2019, titled "Addressing the SDGs in Sustainability Reports: The Relationship with Institutional Factors." This document discusses how sustainability reports relate to institutional factors in the context of achieving the Sustainable Development Goals (SDGs). This shows that the keywords "sustainability report" and "sustainability development" are often discussed and linked to each other in academic literature. The second most cited study also has a title related to sustainability reports. However, it can be inferred from this that research linking sustainability reports with climate change mitigation frameworks has received less attention. This shows the urgency of exploring research that addresses sustainability reports with various existing frameworks directly to provide more comprehensive guidance in sustainability practices.

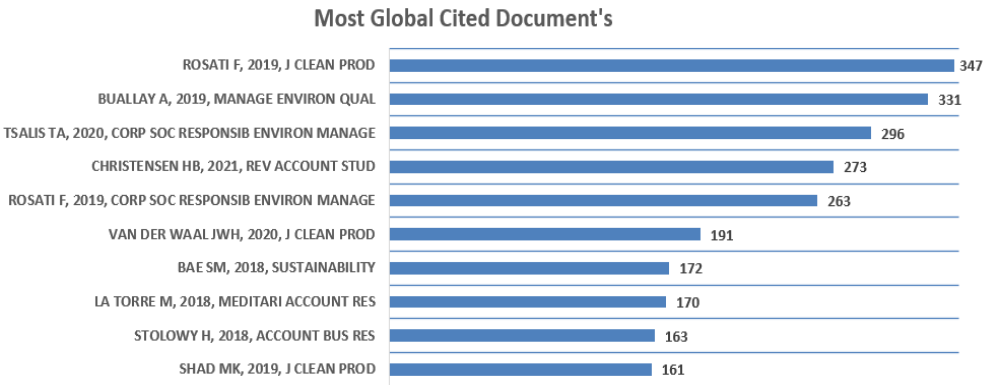

Figure 13. Most global cited documents

5. DISCUSSION

While the adoption of sustainability guidelines has many benefits, there are also several challenges that companies face in their implementation. Some of the challenges identified by the literature include reporting complexity. Companies often face challenges in understanding and applying complex guidelines such as TCFD and IFRS. Implementation costs for collecting data and preparing reports in accordance with TCFD and IFRS guidelines require considerable resources, both in time and cost. However, this study has limitations. The bibliometric approach primary constraint is the possibility of drawn more on certain authors, journals, or countries due to the language or popularity, rather than the quality or relevance of prior studies. This may lead to misleading impression of important research in the field. Additionally, this may hinder us from drawing stronger conclusions and generalizing our findings.

The exclusion criteria and screening process also meant we may have overlooked some contributions to the topic, such as book chapters and other types of publications. Additionally, despite using an appropriate set of keywords, some relevant articles may not have been included, preventing a broader perspective on sustainability in accounting and management. Notably, much of the information we gathered comes directly from reporting institutions' websites and their published reports. In addition, in order to have thorough analysis, it is crucial to consider regional, policy and economic factors that may give impact on the literature. Otherwise, it may cause a bias in analysis and conclusion. Future research should employ different keyword sets and screening criteria and utilize other multidisciplinary databases to broaden the study's conclusions. It should also comparatively explore and analyze literature on regional, policy and economic factors in analyzing the sustainability report and climate change. Lastly, future studies could further contribute to the growing research on the articulation of different impression management techniques.

6. CONCLUSION

Since the early 1990s, it has been recognized that climate change can have profound implications for sustainability. Consequently, a substantial body of research has emerged on this subject. Given the potentially catastrophic consequences of unmitigated climate change in the future, establishing guidelines for reporting indicators is crucial in demonstrating corporate commitment to addressing this global challenge. Rising concerns for the environment and society have prompted companies to enhance their sustainability disclosures, driving the creation of more detailed information.

The bibliometric analysis found some research gaps. First, climate change-related topics lack attention. While there are many studies of sustainability and climate change individually, integrating these two areas lacks attention. Moreover, most research on sustainability reporting and climate change is concentrated in developed countries. This may leave a gap in understanding how businesses in developing countries address this issue. This gap may limit the generalizability of the findings.

Given the limitations, may lead to potential future research on how businesses integrated climate risk into sustainability initiatives and report. Moreover, investigating how businesses in emerging markets address sustainability and climate change, including the regulatory environment and resource constraint, may provide more thorough perspective on sustainability reporting.

This study may give implication on the body of knowledge that bibliometric analysis helps identify key research clusters, influential countries on the topic and most research year to the field. This may help researchers in understanding the development of the literature on sustainability reporting and climate change over time. In addition, by analyzing publication year, country and topics, bibliometric analysis points out research gaps. This enables researchers and policy makers to prioritize new research directions by focusing on areas that have received less attention.

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