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Trend Research Sustainable Developments Goals in Indonesia within ASEAN Nations from 2015 to 2023: A Bibliography Analysis

Abstract: This study aims to identify and analyze the development of research related to sustainable development goals (SDGs) in Indonesia from 2015 to 2023 using bibliometric analysis methods. The SDGs represent a global commitment in addressing various social, economic, and environmental challenges faced by the world today. This study focuses on the main trends developing in SDGs research in Indonesia, including research productivity, collaboration between researchers, and dominant research themes. Bibliometric methods were used to collect and analyze data from various sources, such as scientific journals and reviews available in the Scopus database. The data analysis process involved the use of keyword visualization tools such as VoS Viewer, as well as R-studio Biblioshiny bibliometric analysis software. The results of the analysis show that sustainable development is a trending topic and peaks in 2020-2023. In addition, the evolution of research over a certain half-life (2017-2023) revealed that water sanitation, biodiversity, and food security became the main focus in SDGs-related publications. For almost the past decade, Indonesia has been the country that produced the highest number of SDGs-related articles in the Scopus database. This bibliometric study provides a comprehensive understanding of the development of SDGs research in Indonesia and can be a reference for other researchers to understand the growing trends and fictions in efforts to achieve development goals in Indonesia.

Keywords: Sustainable Development, Bibliometrics, Indonesia, Analysis, Trend.

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Introduction

Sustainable Development Goals (SDGs) is a global agenda launched by the United Nations (UN) in 2015. The main goal of the SDGs is to create a more sustainable world with an emphasis on crucial issues such as eradicating poverty, reducing inequality, overcoming climate change, and environmental preservation (Aji & Kartono, 2022). The SDGs agenda consists of 17 goals covering various aspects of human life, including health, education, food security, justice and environmental conservation (Irhamyah, 2019; Arlinwibowo et al., 2020).

Before the adoption of the SDGs, there were the Millennium Development Goals (MDGs). MDGs is a program launched by the United Nations in 2000 for the period from 2000 to 2015. (Oktavia et al., 2022). The MDGs are a series of eight goals that aim to address social and economic problems around the world, such as eradicating extreme poverty, improving maternal and child health, and gender-based rape (Oratmangun, 2003). The MDGs created the basis for global attention to sustainable development, and the SDGs then continued this role with a broader and deeper focus.

Indonesia, as a UN member country, has committed to achieving these SDGs targets. However, achieving these goals in Indonesia is faced with various challenges, such as the impact of climate change, global warming, rapid urbanization, health problems and economic inequality (Malihah, 2022; Putra & Suflani, 2022; Sitorus et al., 2024). These challenges show the complexity of efforts to achieve the SDGs in Indonesia. Therefore, to achieve sustainable development goals in Indonesia, a deep understanding of research trends that have been carried out in the context of the SDGs in this country is very important.

Bibliometric analysis, as a research method that uses bibliographic data to measure and analyze research trends, will be used in this research. This approach will provide a more comprehensive understanding of the development of research related to SDGs in Indonesia. Based on bibliometric analysis, this research can identify the growth in the number of publications, evaluate the most dominant research topics, analyze collaboration between researchers, and identify the literature sources that are most widely used in related research (Ulwiyah et al., 2023; Zafrullah et al., 2023). This bibliometric analysis will help identify the most significant research trends in the context of the SDGs in Indonesia, provide a strong data basis for decision making, and guide future research directions.

Bibliometric research has been carried out in various fields, including SDGs studies that use bibliometric analysis (Maryanti et al., 2022; Obaideen et al., 2023; Pizzi et al., 2020; Prieto-Jiménez et al., 2021; Setiyowati et al., 2022; Sweileh, 2020). However, the difference between this research and previous studies is the special focus on analyzing SDGs in Indonesia. This research makes an important contribution in completing the understanding of the latest research trends on SDGs in Indonesia, as well as providing comparisons with ASEAN countries.

The main aim of this research is to conduct a bibliometric analysis of SDGs research trends in Indonesia over the last decade. In this context, this research will attempt to answer the following research questions:

(Q1) Evolution of publication: How is the trend of publication growth and trends of Sustainable Developments goals?

(Q2) Country of literature source: How do global trends regarding SDGs publications compare with trends in Indonesia and other ASEAN countries?

(Q3) Collaboration network analysis: What are the trends in collaboration and significant contributions?

(Q4) Main keywords: What are the keywords that emerge and dominate themes in literature related to SDGs, especially in ASEAN?

It is hoped that this research will provide valuable insights for researchers, the government and other stakeholders in efforts to achieve sustainable development goals in Indonesia. It is also hoped that the results of this research can guide future researchers in choosing research topics that are relevant and have the potential for collaboration in the context of the SDGs.

Research Methods

Bibliometric mapping analysis is a tool for analysis which systematically evaluates the scholarly impact and influence of academic articles and researchers within a specific field of study. Bibliometric mapping is recently gaining more interest in different disciplines (Aria & Cuccurullo, 2017; Arici et al., 2019; Song et al., 2019). Perhaps, the suitability of bibliometric for science mapping may have caused this extending acceptance among scholars (Aria & Cuccurullo, 2017). Conducting bibliometric mapping analysis is a systematic process that involves several key steps, including data collection, screening, extraction, and synthesis.

Literature search and data collection

The paper bibliometric analysis is retrieved from Elsevier Scopus database, which is known as the world largest abstract and citation database of peer-reviewed literature (Chi, 2003). Scopus also provides the most documents for bibliometric analysis and also offers search analysis tools for representative figures (Alryalat et al. 2019). The search string for this study is made up of several compound phrases joined together with the OR operator. The first search field contained keywords “sustainable” AND “development” AND “goals”. The initial query without any filtering gained 64732 documents as the results. The search and retrieval of the data were conducted on September 12 2023. These results were later filtered to exclude some irrelevant items based on our inclusion and exclusion criteria. The inclusion and exclusion criteria are presented in Table 1. In total, 1092 papers were collected after refining based on the inclusion and exclusion. Then, these data were exported for the next analysis. The summary information of the dataset presented in Table 2.

Table 1. Inclusion and exclusion criteria for retrieving the dataset

| | Code | Criteria |
|--------------------|------|---|
| Inclusion Criteria | IC1 | Articles containing one of the keywords in either title, abstract, or keywords. |
| | IC2 | Documents written in the English language |
| | IC4 | Articles in journals and conferences papers |
| | IC5 | Subject areas in "Environment, Social, energy, multidisciplinary, arts" |
| Exclusion Criteria | EC1 | Published articles before 2015 |

Table 2. Data synthesis indicating primary information and summary of the dataset

| Description | Results |
|---------------------------------|------------|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 2048:43:00 |
| Sources (Journals, Books, etc) | 316 |
| Documents | 1088 |
| Annual Growth Rate % | 51,38 |
| Document Average Age | 2,17 |
| Average citations per doc | 9,329 |
| References | 1 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 4029 |
| Author's Keywords (DE) | 2895 |
| AUTHORS | |
| Authors | 5102 |
| Authors of single-authored docs | 75 |
| AUTHORS COLLABORATION | |
| Single-authored docs | 81 |
| Co-Authors per Doc | 5,13 |
| International co-authorships % | 35,75 |
| DOCUMENT TYPES | |
| Article | 578 |
| Research article | 3 |
| Article conference paper | 2 |
| Conference paper | 404 |
| Conference paper article | 3 |
| Conference paper review | 1 |
| Review | 96 |
| Review conference paper | 1 |

Research Results and Discussion

Data Preprocessing with VOS Viewer. A crucial component of bibliometric analysis and visualization is data pretreatment, which makes sure the incoming dataset is clear, pertinent, and prepared for in-depth examination. This section's main goal is to ensure the data quality assurance measures taken to eliminate duplicates, ensure consistency in metadata, and maintain data integrity. This study is using VoS viewer for visualizing and interpreting the provided data. VoS viewer's text mining functionality allows users to analyze large amounts of text data, aiding in bibliometric mapping and bibliometric analysis (Eck and Waltman, 2011). The aims of the analysis are to explore the underlying structure and relationships within a research dataset. The initial data collection phase involved setting a minimum threshold of 10 occurrences, resulting in the selection of 655 articles that met this requirement. Afterwards, 393 relevant articles were found for visualization after this dataset was analyzed using VoS viewer. The articles were subsequently clustered into four distinct topics, each represented by a different color: Red, Blue, Green, and Yellow (see Figure. 1). The clusters reveal associative relationships among specific terms or keywords within the dataset. For instance, the associatively connected "Red" cluster has 152 terms, indicating an integrated research theme or topic. Similarly, the "Green," "Blue," and "Yellow" clusters also show associative connections among 83, 85, and 73 terms, indicating distinct yet interconnected areas of research.

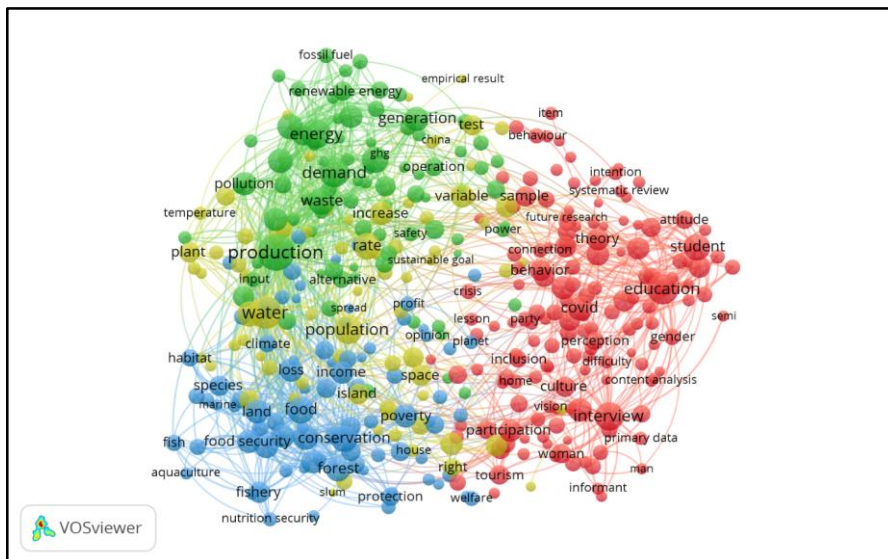


Figure 1. VoS Viewer visualization

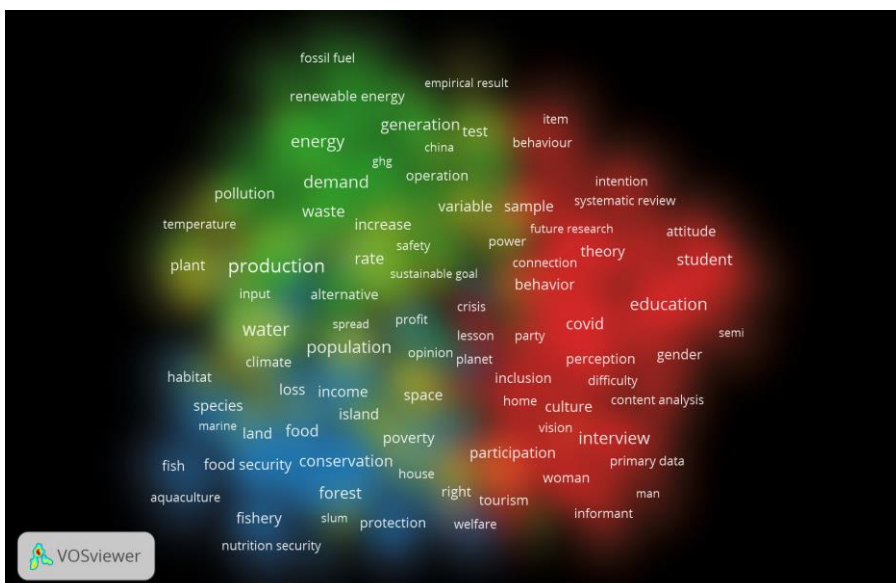


Figure 2. Visualization VoS Viewer for Theme Density

Data analysis using bibliometrix R-package software. This study used the open-source bibliometrix R-package software, which offers a range of tools for performing quantitative research in bibliometrics. Bibliometrix is R-package software which was developed by Aria and Cuccurullo in 2017. It has the main algorithms for conducting statistical and science mapping analysis. The recent versions of bibliometrix R-package (i.e., 2.0 upwards) contains a web interface app (Biblioshiny) introduced to aid users without having a coding skills expert to conduct bibliometric analysis. Data can be imported in BibTex, CSV, or Plain Text formats from Web of Science or Scopus databases using the Biblioshiny interface. The study analysis is presented in the result section.

(Q1) Evolusi publikasi: How is the trend of publication growth and trends of Sustainable Developments goals?

This section presented the annual scientific production of articles in the field of Sustainable Developments goals from 2020 to 2023. Analysis from the bibliometrix R package shows that the field of Sustainable Development goals has a 51,38% annual growth rate (see Figure. 13) of scientific production from 2020 to 2023. As shown in Figure. 3, generally, the number of articles produced has increased over time, showing a noticeable peak in 2020 and a steady increase in 2021 and 2022. This points to an increasing amount of research output in the area being studied, which may indicate a rise in interest and activity in the field in recent years.

On the other hand, there have been some variations in the average number of citations for articles in each year. For example, the comparatively high average citation count of 8.82 in 2016 suggests that articles published in that year received more citations on average. But in the years that followed, the average number of citations fell, with notable drops in 2018 and 2019. It is noteworthy that the average number of citations rose once more in 2020 and has stayed mostly steady in 2021 and 2022.

Table 3. Articles production and average citation per year

| Year | Articles production | Average Citation |
|------|---------------------|------------------|
| 2015 | 7 | 4,59 |
| 2016 | 13 | 8,82 |
| 2017 | 17 | 7,37 |
| 2018 | 96 | 1,87 |
| 2019 | 88 | 2,95 |
| 2020 | 176 | 3,03 |
| 2021 | 259 | 3,02 |
| 2022 | 239 | 2,13 |
| 2023 | 193 | 1,05 |

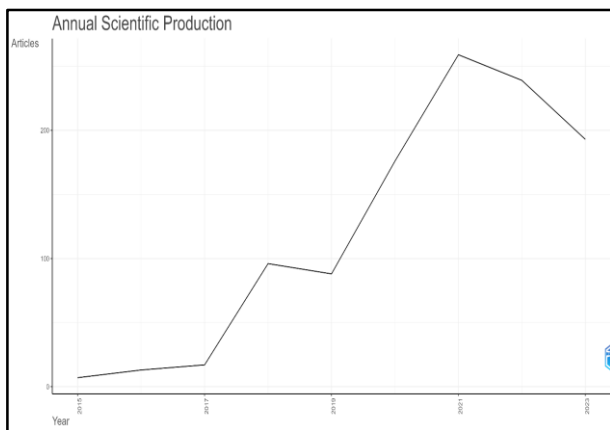


Figure 3. Annual scientific production

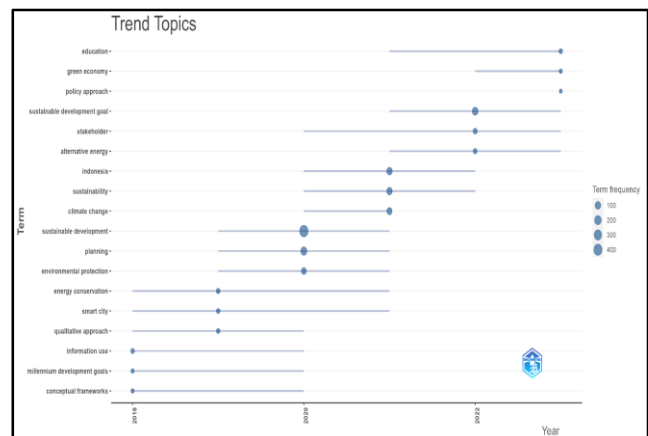


Figure 4. Trend topics

The results of trending topics show that in 2018-2022 the topics of "sustainable development", "planning", "sustainable development goals" are the most researched topics followed by the topics of "Indonesia", "sustainability", and "climate change".

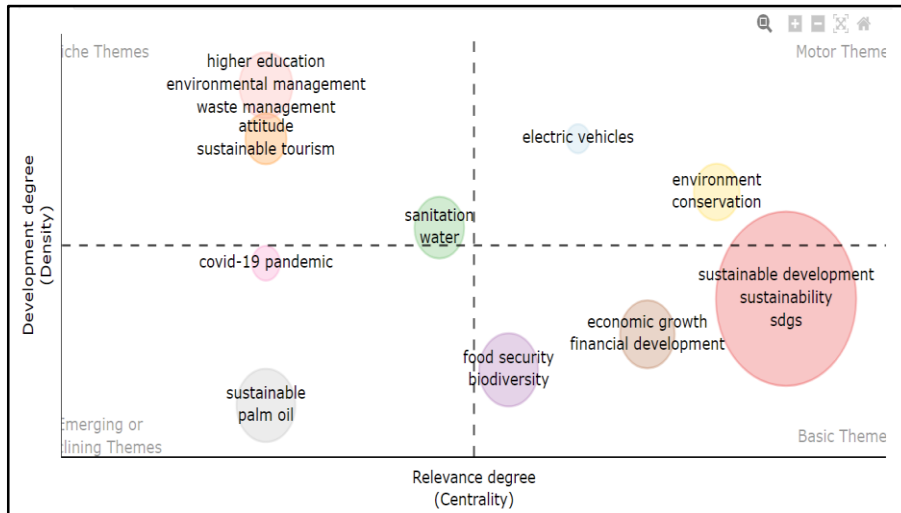


Figure 5. Trend topic based on 2017-2023 time slice

(Q2) Country of literature source: What is the global trend in SDGs publications when compared to the trend in Indonesia and other ASEAN countries?

Based on the country of origin of the corresponding author, the biblioshiny analysis results are divided into single country publications and multiple country publications with a focus on analyzing among ASEAN countries, which are dominated by Indonesia, Malaysia, Thailand as shown in Figures 6 and 7. Figure 8 displays the development of productivity and publication trends in the period 2015-2021. As a result, Indonesia shows a significant increase over time compared to other ASEAN nations such as Malaysia and Thailand.

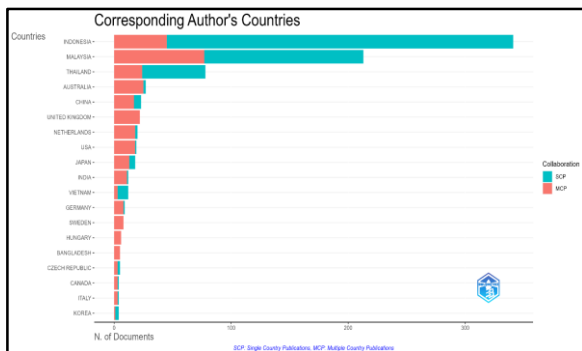


Figure 6. Corresponding author's country

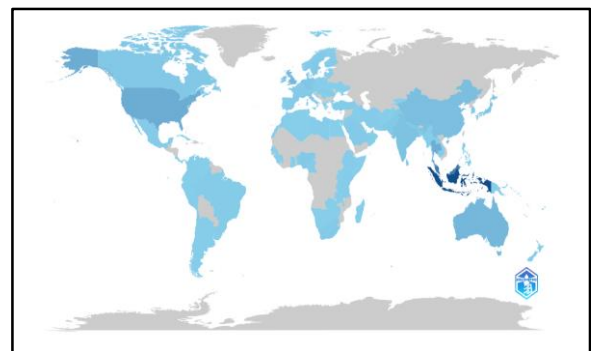


Figure 7. Maps distribution of corresponding author's country

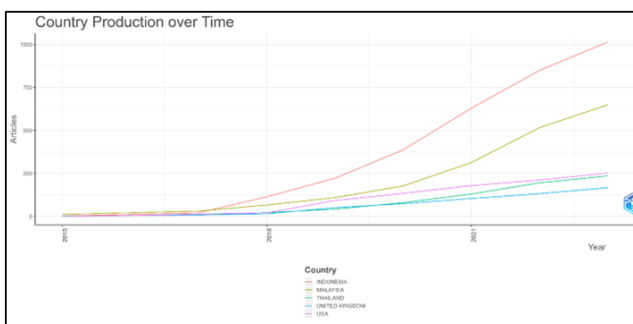


Figure 8. Country production overtime

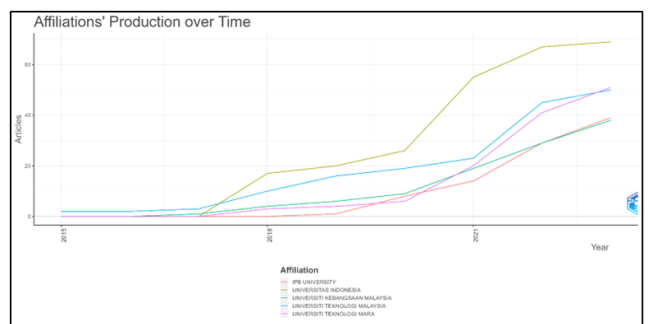


Figure 9. Affiliations' production over time

Focusing on Indonesia as a country in ASEAN with active publications related to the SDGs theme, the institutions with the highest production of articles related to this theme in Indonesia are produced by the University of Indonesia and IPB University. When compared to other institutions in ASEAN, Universiti Teknologi Malaysia and Universiti Teknologi Mara are the institutions with high productivity in producing articles related to SDGs. Figure 10 shows that the country with the highest number of citations is Malaysia.

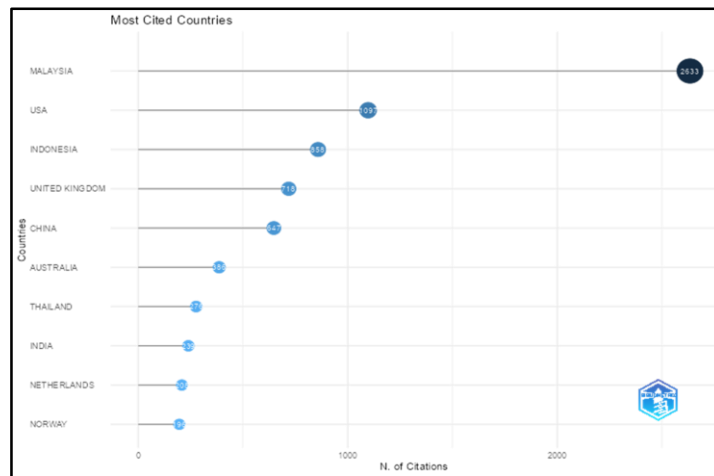


Figure 10. Most cited countries

(Q3) Collaboration network analysis: What are the collaboration trends and significant contributions?

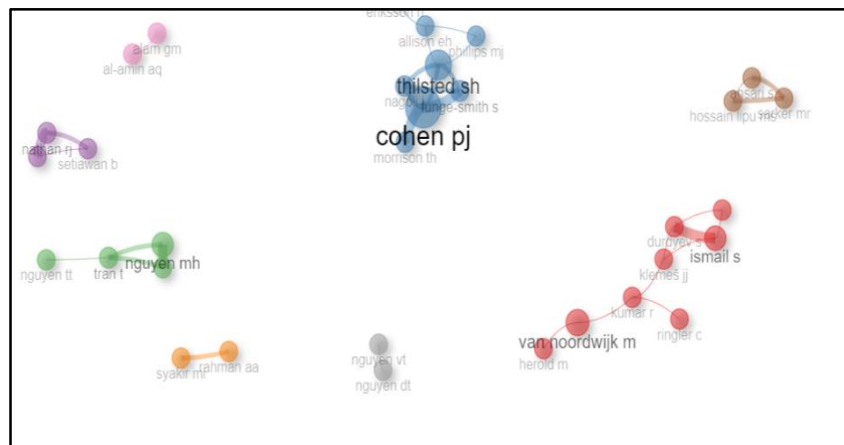


Figure 11. Collaboration between authors

Co-authorship networks presented patterns of scientific collaboration, revealing differences between subjects and over time (Newman, 2004). Based on the dataset that have been analyzed, there are 5102 authors involved in Sustainable development goals research. The network visualization can be seen in figure 10. Large nodes in the collaborative author visualization created with VOS Viewer signify researchers or research groups actively working together within a particular research cluster. The number of collaborations between the authors are divided into 8 clusters. The first big clusters (presented with blue color) consist of 7 authors, with the biggest node for this cluster “Cohen Pj”.

(Q4) Major keywords: What are the keywords that emerge and dominate the themes in the literature related to SDGs, especially in ASEAN?

The graph (see Figure. 12) displaying a word's frequency over time from 2015 to 2023 in the field of Sustainable Development Goals research. By analyzing word frequency over time, it offers insights into the evolving landscape of a research field (Moral-Muñoz, 2020). Additionally, it can also help the identification of research trends within a field, by making it easier to distinguish between variations in keyword frequency and whether those variations indicate a rise or a decrease in applications.

Based on a line graph (Figure. 12), we might observe that the frequency of "Sustainable Development" is consistently high throughout the period, indicating its sustained importance in the literature. In contrast, "Planning" might show a stable or slightly increasing trend, suggesting that it is still relevant but not as important as "Sustainable Development." "Sustainable Development Goal" might reveal a rising trend, reflecting the increasing emphasis on tracking SDGs progress.

The frequency of specific countries like "Indonesia" and "Malaysia" could demonstrate variations, which may indicate changes in research focus or regional interest over time. Terms like "Climate Change" and "Environmental Protection" might show increasing trends, suggesting the significant increase of environmental issues in SDGs research. Moreover, "Economics" and "United Nations" could show relatively stable patterns, demonstrating that these ideas are still relevant in SDGs research

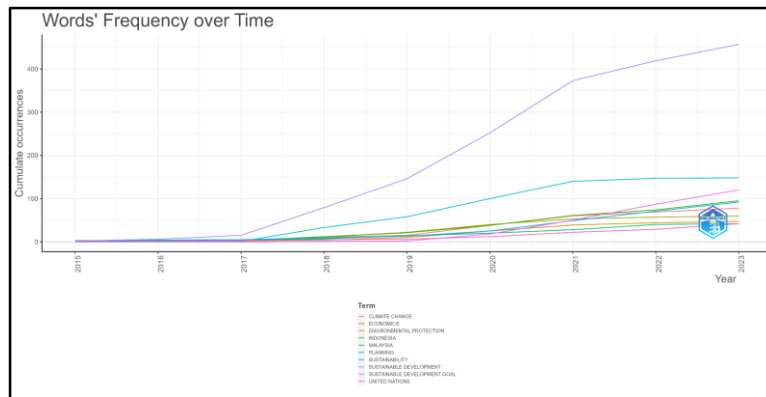


Figure 12. Word's frequency over time

Discussion

A collection of international objectives, the Sustainable Development Goals (SDGs) were created under the 2030 Agenda for Sustainable Development (Bank et al., 2015). This study aims to identify and analyze the development of research related to sustainable development goals (SDGs) in Indonesia from 2013 to 2023 using bibliometric analysis methods. The SDGs represent a global commitment to address the social, economic, environmental and scientific challenges faced by the world today. This study focuses on the main trends developing in SDGs research in Indonesia, including research productivity, collaboration between researchers, and dominant research themes. This article analyzes research trends related to SDGs themes obtained from Scopus data. In general, it is shown in Figure 13.

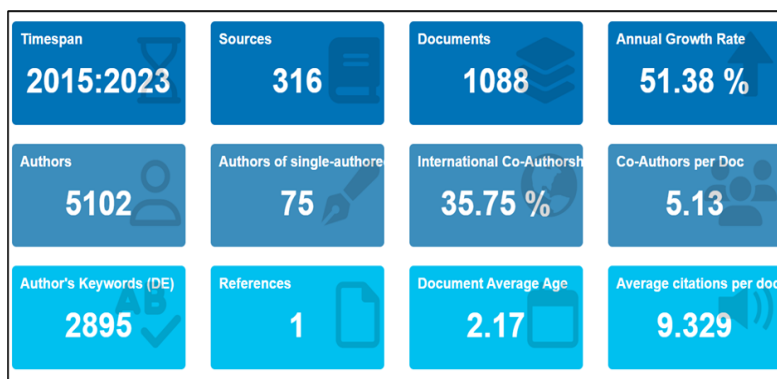


Figure 13. General information

(Q1) Evolution of publications: How is the trend of publication growth and trends of Sustainable Developments goals?

In the period 2015-2023, the number of published articles related to the topic of sustainable development goals (SDGs) generally increased. Except in 2019, this number decreased from 96 articles to 88 articles. Meanwhile, the average number of articles cited tends to fluctuate over time. The time slice between

2017-2023 in Figure 5 shows the direction of the quadrant of research topics for the SDGs theme. The quadrant with specific "niche" themes in the first cluster is "higher education", "environmental management", and "waste management". The second cluster consists of "attitude" and "sustainable tourism". The themes occupying the quadrant with the most central theme relevance in this theme are "sanitation" and "water".

The majority of research related to SDGs is dominated by basic themes such as those addressed by the first cluster "sustainable development", "sustainability", and "SDGs". Then the second cluster "economic growth" and "financial development". Finally, themes that are close to relevance are "food security" and "biodiversity". While the topics that are observed as trending topics 2018-2022 are about "sustainable development", "planning", "sustainable development goals" is the most researched topic followed by the topic "Indonesia", "sustainability", and "climate change". This shows that along with the development of science and technology, environmental issues become a branch of science that is still an issue.

(Q2) Country of literature source: What is the global trend in SDGs publications when compared to the trend in Indonesia and other ASEAN countries?

Figure 8 shows the development of productivity and publication trends in the period 2015-2021. As a result, Indonesia shows a significant increase over time compared to other ASEAN countries such as Malaysia and Thailand. Unfortunately, this is inversely proportional to the number of citations where Malaysia is the country with the highest number of citations ahead of Indonesia. If focused only among ASEAN countries, table 2 shows that the top three are Malaysia, Indonesia, and Thailand.

Table 4. Most cited countries among ASEAN

| COUNTRY | TC | AVERAGE ARTICLE CITATIONS |
|-------------|------|---------------------------|
| MALAYSIA | 2633 | 12,4 |
| INDONESIA | 858 | 2,5 |
| THAILAND | 276 | 3,5 |
| VIETNAM | 101 | 8,4 |
| SINGAPORE | 29 | 14,5 |
| LAOS | 22 | 22 |
| CAMBODIA | 21 | 7 |
| PHILIPPINES | 7 | 7 |
| BRUNEI | 1 | 1 |

Regarding productivity, Indonesia as a country in ASEAN that has the highest number of article production with the theme of SDGs, at the affiliation level, the University of Indonesia is the affiliation with the highest number of articles with 69 articles.

Table 5. Most relevant affiliations

| COUNTRY | TC |
|--------------------------------|----|
| UNIVERSITAS INDONESIA | 69 |
| UNIVERSITI TEKNOLOGI MARA | 51 |
| UNIVERSITI TEKNOLOGI MALAYSIA | 50 |
| IPB UNIVERSITY | 39 |
| UNIVERSITI KEBANGSAAN MALAYSIA | 38 |
| UNIVERSITI SAINS MALAYSIA | 33 |
| DIPONEGORO UNIVERSITY | 30 |
| HASANUDDIN UNIVERSITY | 30 |
| UNIVERSITAS GADJAH MADA | 29 |
| BINA NUSANTARA UNIVERSITY | 27 |
| UNIVERSITY OF MALAYA | 27 |

| | |
|--------------------------------|----|
| UNIVERSITAS PADJADJARAN | 23 |
| UNIVERSITAS SEBELAS MARET | 22 |
| CHULALONGKORN UNIVERSITY | 21 |
| UNIVERSITI MALAYSIA TERENGGANU | 21 |
| CHIANG MAI UNIVERSITY | 20 |
| UNIVERSITAS AIRLANGGA | 19 |
| UNIVERSITI PUTRA MALAYSIA | 19 |

(Q3) Collaboration network analysis: What are the collaboration trends and significant contributions?

The results of the data analysis in Figure 11 show the coauthorship relationship for SDGs-related themes with a significant number, meaning that this theme has its own uniqueness in addition to its urgency in the current global discussion focus. These big nodes denote a major influence and a central position within the cluster (Markovich, 2017). It means that the researcher is vital in fostering collaboration, frequently acting as pioneers or significant contributors in specific fields of study. Moreover, the red cluster also held a significant position for authors' collaboration in Sdgs research. There are 8 authors visualized with relatively similar-sized nodes, suggesting that the authors contributed to the network with approximately equal prominence (Newman, 2004).

(Q4) Major keywords: What are the keywords that emerge and dominate the themes in the literature related to SDGs, especially in ASEAN?

Even regionally in ASEAN, Indonesia and Malaysia appear to be actively discussing issues related to "sustainable development" in various aspects such as "sustainable biogas production" (Farobie et al., 2022); "Application of the SDG principles in interior architecture" (Affandi et al., 2022); "Sustainable interior economy planning" (Marsahala et al., 2023); "ecolabel and certification (Rais & Suzianti, 2021) and so on.

Table 6. Keyword trend development

| YEAR | SUSTAINABLE | PLANNING | SUSTAINABLE DEVELOPMENT GOALS | SUSTAINABLE | CLIMATE CHANGE | ENVIRONMENTAL PROTECTION |
|------|-------------|----------|-------------------------------|-------------|----------------|--------------------------|
| 2015 | 2 | 0 | 0 | 1 | 0 | 2 |
| 2016 | 6 | 0 | 0 | 4 | 0 | 3 |
| 2017 | 15 | 1 | 0 | 5 | 4 | 4 |
| 2018 | 79 | 33 | 1 | 9 | 11 | 11 |
| 2019 | 146 | 58 | 2 | 13 | 15 | 22 |
| 2020 | 252 | 100 | 18 | 25 | 38 | 40 |
| 2021 | 373 | 140 | 50 | 49 | 60 | 53 |
| 2022 | 419 | 147 | 87 | 71 | 69 | 57 |
| 2023 | 457 | 148 | 120 | 92 | 78 | 60 |

As we move towards the achievement of the SDGs by 2030, themes related to "sustainability" "climate change" and "environmental protection" are increasingly popular for study. This can also be influenced by conditions where the level of environmental pollution and exploitation of natural resources is increasing both related to forests, oceans, and food security (Azra et al., 2022; Levin et al., 2020; Malau et al., 2021; Prayitno et al., 2020; Roy et al., 2022; Suwarno et al., 2018). The development of research keyword trends on the topic of sustainable development goals over time, especially in Indonesia, indicates that sustainability issues are a priority and have an urgency to be studied more deeply in terms of science. This is indicated by the increasing number of scientific research productions in various fields related to sustainability. Even this still encounters obstacles in its implementation, therefore research related to SDGs still has the opportunity to be studied further as an evidence-based learning that can be used as a reference for decision makers.

The research trends presented in this article illustrate that sustainability topics are experiencing significant developments and still have opportunities to be further developed and researched in the future. The good thing is that the awareness of sustainable development goals in Indonesia and other ASEAN countries such as Malaysia and Thailand has initiated research in this field during 2015-2023 and beyond.

Conclusions

Based on the bibliographic review of research trends related to SDGs with a focus on Indonesia among ASEAN countries, it shows significant developments, especially on several topics such as "sustainable development" "SDGs". At a more specific level, the quadrant direction of research topics for the SDGs theme provides information that the quadrant with special "niche" themes in the first cluster is "higher education", "environmental management", and "waste management". The second cluster consists of "attitude" and "sustainable tourism". Indonesia as a country in ASEAN has the highest rate of scientific article production, indicating that Indonesia has a clear awareness of sustainability issues. This study illustrates that the best topics of SDGs have the potential to be further explored in the future, especially towards SDG 2030. Further research needs to be done to help catalyze issues around sustainability as scientific evidence and reference for decision makers.

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