Journal of Education and Learning (EduLearn)
Vol. 19, No. 1, February 2025, pp. 350~361
ISSN: 2089-9823 DOI: 10.11591/edulearn.v19i1.21789

Mapping the landscape of sustainability literacy research in the Indonesian technical and vocational education

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Article Info

Article history:

Received Jan 1, 2024
Revised Mar 18, 2024
Accepted Mar 27, 2024

Keywords:

Bibliometric
Indonesia
Scopus
Sustainability literacy
Sustainable development
TVE

ABSTRACT

Technical and vocational education (TVE) in a country cannot only talk about a narrow scope in the world of education and work but also play a role in ensuring someone achieves a prosperous life socially, economically and environmentally without forgetting preparation for the next generation. This research will visualize and map the development trend of publications on sustainable development in the TVE scope worldwide and in Indonesia. The method used is descriptive quantitative and bibliometric analysis with research data taken from the Scopus database. The results of the study show that increasing research is essential for the development and efforts of the TVE community to increase the achievement of sustainable development goals (SDGs). Indonesia is recorded as having only started publication in 2017, with a total publication of 42 documents until early 2024. Interestingly, there has been a decline in the number of publications in the last two years. The results of the bibliometric analysis show that research topics in Indonesia have not yet demonstrated success in linking them to the social, economic and environmental spheres. Further research is recommended to conduct a systematic literature review to identify global action program (GAPs) in sustainable development research in TVE communities.

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1. INTRODUCTION

Technical and vocational education (TVE) can not only talk about understanding narrow and momentary skills for someone to be able to work. However, TVE needs to expand its discussion towards a comprehensive understanding that includes values and attitudes towards sustainable development [1], while also considering the balance between economic development, equality, welfare, and environmental concerns [2], [3]. The ideals in the sustainable development discourse align with the 'spirit' of TVE, namely the provision of inclusive, equitable, and fair education [4]. Education has become closely linked to life, no longer just about eradicating illiteracy and conveying the cognitive domain [5]. TVE must ensure that the next generation can adapt and work in a developing global industry and a work environment that can change at any time [6]. However, TVE is vulnerable because the requirements of industry professional standards influence it based on needs that are continually evolving following global trends [7], and the potential of educational organizations [8]. Current criticism of TVE is that it focuses too much on job-finding skills and

productivity [9], and ignores its traditional role in a person's transition into adulthood for a decent shared life [10]. Most current TVE policies prioritize rapid supply growth over industry sustainability needs [11]. Research from Briede and Drelinga [12], shows that vocational school graduates contribute to unemployment despite high demand because they do not have general soft skills for the ability to adapt to global-level interactions. Abd. Samad *et al.* [13] also confirm this, saying that the increasing number of unemployed was caused by competition for foreign workers and immigrants as well as the poor attitude of local workers. Increasing the implementation of sustainable development in TVE is a form of investment that can improve the situation of various problems [14]. In the most fundamental principle, TVE can play a role in preparing human capital, which in the end will help improve a nation's economy and improve the quality of life of its people [15]-[17].

The push for TVE to play an active role in the legal sustainable development discourse began with a joint agreement by 160 countries at the World Education Forum in Incheon in 2015, which sought to achieve sustainable development goals (SDGs) through the education sector by 2030 [18]. Each country's government is expected to promote sustainable development seriously, even though it is not legally binding [1]. However, five years after the launch of the 2030 agenda, although progress has been made in the first phase of its implementation, progress in efforts to achieve it is not proceeding at the required pace [19]. As is known, TVE is in a unique position and is an essential part of making a significant contribution to discussions on sustainability in a country. TVE can anticipate skills for future needs that strengthen resilience and social capital [20]. For a government in a community of developing countries that wants to catch up economically, increasing investment and revitalizing TVE is one of the right solutions [10]. Efforts made on TVE can contribute to human resource development [21], increase social cohesion [22], achieve financial sustainability [23], environmental responsibility [24], and promote political change [25]. Sustainability literacy is about how socio-political, economic, and environmental issues that prioritize common interests are created [26], through the harmonization of science and technology [27]. Therefore, countries continue to strive to develop quality vocational education. Through the focused development of skills and knowledge, TVE can become not only a foundation for individual success but also a driving force in realizing a country's SDGs [28].

Based on the SDGs report [29], Indonesia shows an increasing trend every year, with a score from 2015 of 64.7 to 2023 of 70.16. The overall score results from measuring total progress in achieving 17 SDGs and as a percentage of SDGs achieved by a country. However, Indonesia is only ranked 75th among all countries and 4th among ASEAN countries. Indonesia's current position certainly needs to be re-evaluated. Indonesia is projected to become the fifth largest country in the world in 2045, with a population of 309 million people [30]. Apart from that, 2045 will also be the time when Indonesia will be exactly 100 years old. So, morally, Indonesia is responsible for increasing its efforts to achieve the SDGs for regional communities and global citizens, one of which can be achieved through the TVE community. The Indonesian TVE community can actively contribute to various global issues reported by the World Economic Forum [31], such as extreme weather events, artificial intelligence (AI)-generated disinformation, socio-political polarization, cost of living crisis, cyber-attacks, economic decline, supply chain disruption, escalation state conflict, attacks on infrastructure, and disruption of food supplies. Then, if we look at the report on the achievement of Indonesia's SGDs [32], the Indonesian government has synergized SDGs with the Tri Dharma of higher education. By December 2022, there will be 36 SDGs Centers established in various universities in Indonesia, with 69% being state universities and 31% being private universities. However, Indonesia's rough participation rate in 2022 is 31.16%, still below the target of 31.52% [32]. The hope of building SDGs Centers in various universities in Indonesia is to increase the publication of research in the form of literature studies or prototype projects that are implementable or evaluation of sustainable development programs by educational institutions, including the TVE community. This publication data initiated by the TVE community is not found in various reports related to achieving SDGs in Indonesia.

Therefore, mapping the development of sustainable development research studies within the scope of TVE Indonesia is highly urgent to help relevant stakeholders increase their contribution. Ukuma *et al*. [33] argue that rehabilitation in TVE that leads to sustainability is recommended to add focus to self-reliance and scientific development. An excellent sustainable development education and research system in TVE is a prerequisite for innovation and economic growth [34]. This research aims to visualize and map the development trend of research publications on the topic of sustainable development in the scope of TVE throughout the world and Indonesia. So, the results obtained from this research are a mapping and comparison study by processing publication information from a database using quantitative descriptive and bibliometric analysis. Furthermore, this research has two research questions, namely i) What is the landscape of research trends on the topic of sustainable development in the scope of TVE in the Scopus Database in the world and Indonesia and ii) What are the opportunities to improve sustainable development programs through the TVE community in Indonesia. The general aim is to provide information about the importance of

increasing sustainability literacy in TVE through literature studies and implementation in each country to support the achievement of the SDGs.

2. METHOD

This research used quantitative descriptive techniques and bibliometric analysis assisted by VOSviewer software version 1.6.20, Zotero ver. 6.0.30, Google Docs, and Google Sheets. The data used comes from the Scopus database for all recorded time. Researchers choose Scopus because it is one of the largest curated abstract and citation databases, with extensive global and regional coverage of scientific journals, conference proceedings and books. Scopus has a strict screening process ensures only the highest quality data is indexed through [35].

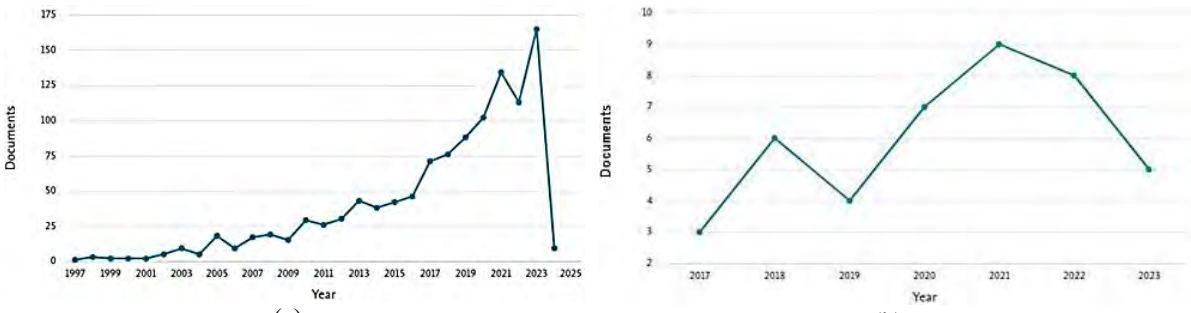
The first stage of this research is determining the query (keyword formula) used in the search engine on the Scopus web page. The query is created by entering several words representing the terms of Sustainability Development in Technical and Vocational Education. The query used for the literature search were TITLE-ABS-KEY (("Education for Sustainable Development" OR "ESD" OR "sustainability" OR "sustainability development" OR "SDGs" OR "sustainable development" OR "SDG") AND ("Vocational" OR "Vocational Education" OR "Vocational Education and Training" OR "VET" OR "TVET" OR "Technical and Vocational Education and Training" OR "TVE" OR "Technical and Vocational Education" OR "Training Education")). The search was conducted on 16 January 2024.

In the second stage, carry out a search with a query specified in the Scopus search engine. At this stage, there is no filtering mechanism. All data obtained will be saved and exported into a file with the extension research information systems (RIS). This is search data, which will later represent research trends in all countries. Then, the third stage is to filter the previous results to display publications based only on the country of Indonesia. The filtering results are then saved as a file with the RIS extension. The fourth stage, carrying out the data processing necessary to carry out comparative studies, presents data in graphs, tables, and bibliometric visualizations using the applications mentioned previously. The final stage is to conduct a comparative study of publication data from all countries and Indonesia.

3. RESULTS AND DISCUSSION

3.1. Distribution of publication documents by year

The distribution of annual scientific production can be seen in Figure 1. In Figure 1(a), the graph shows that there is a trend of increasing publications from 1997 to 2024 by all countries. The graph line shows the fluctuating production of scientific papers in 2023 it has the most publications at more than 100 documents. Meanwhile, Figure 1(b) shows a graph of the number of publications originating from Indonesia. We can see a fluctuating graph. The total number of publications from Indonesia recorded from the Scopus database was only 42 documents from 2017 to 2024. At least in the last two years, the number of publications has decreased.



(a) (b)

Figure 1. Number of annual publications by (a) all countries and (b) Indonesia

3.2. Distribution of publication documents across countries

From the search results in the Scopus database, 1,119 documents were collected. Scientific production data by country can be seen in Figure 2. This image is a world map landscape with colour gradations produced through the chart feature on Google Sheets. The blue areas are countries that have scientific research. The colour brightness level will represent the number of documents produced. The darker

the blue, the more numerous the document. Meanwhile, countries where there is no data do not have a colour. Based on the visualization in Figure 1, overall, there is a large global action program (GAP) between countries regarding the number of scientific publications. Based on the database from Scopus, the United States, China, United Kingdom, Australia, Germany, Malaysia, Russian Federation, Indonesia, India, and Canada are the ten countries of origin with the most documents, respectively.

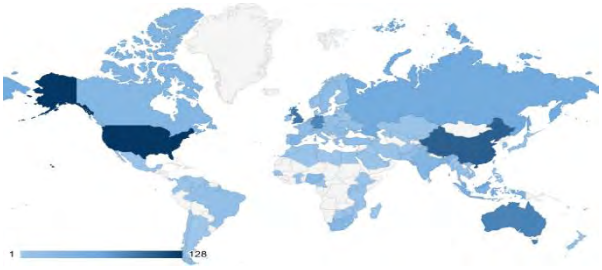
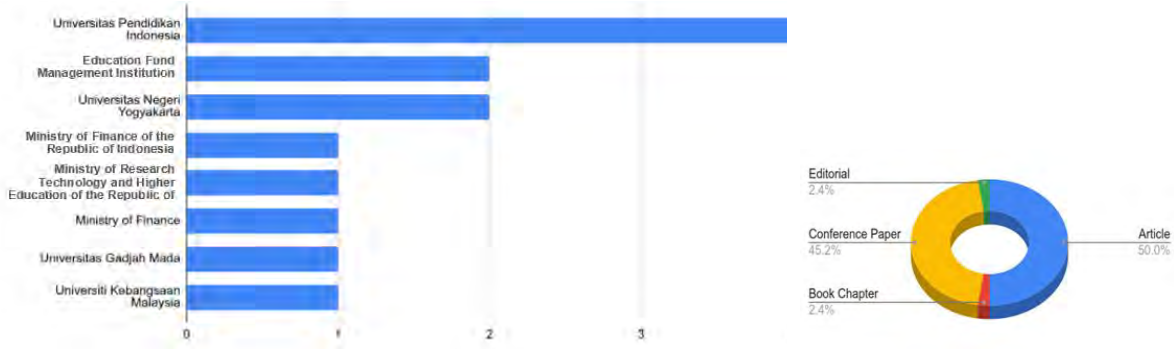


Figure 2. Distribution of publication documents across countries

3.3. Distribution publication documents by funding sponsor, type, and subject area

Figure 3 is a graph that illustrates the distribution of published documents in Indonesia based on sponsor funding and document type. Based on Figure 3(a), eight institutions fund several publication documents. However, of these eight institutions, only four papers out of 42 publications have the highest number of documents, namely the Indonesian Education University. Three institutions originate from government institutions, namely management and education institutions, the Ministry of Finance and the Ministry of Research, technology and Higher Education of the Republic of Indonesia; the number of documents is still under two. There is even one institution that comes from outside Indonesia, namely Kebangsaan Malaysia University. Then Figure 3(b) shows that the 42 publications are divided into four types of documents-the editorial, conference paper, book chapter, and article. Half of them are article-type publications. Figure 4 shows that the subject area of the 42 documents is 12, of which the most numerous are publications with a subject area in social science, followed by environmental science.



(a) (b)

Figure 3. Count of publication documents based on (a) funding sponsor and (b) type of document

Figure 4. Count of publication documents by subject area

3.4. Distribution of publication documents by affiliate institutions in Indonesia

In Indonesia, with 42 documents, it has affiliations with several higher education institutions. There are at least 28 institutions affiliated with these documents. More details can be seen in Table 1. The data in the table shows that the largest institution is the Indonesian Education University, with 14 papers. It can be seen that there are still a few higher education institutions in Indonesia that produce sustainable development research in the TVE scope with an average of under three documents. Almost half of the 28 institutions even come from outside Indonesia, such as Universiti Kebangsaan Malaysia, Universiti Utara Malaysia, The Australian National University, National Yunlin University of Science and Technology, University of Benin, Technische Universität Dresden, Universiti Teknologi Malaysia, ANU College of Business and Economics, Razak Faculty of Technology and Informatics, Universiti Malaya, Universiti Tun Hussein Onn Malaysia, and Eastern Visayas State University.

Table 1. Count of document (CoD) by affiliates in Indonesia

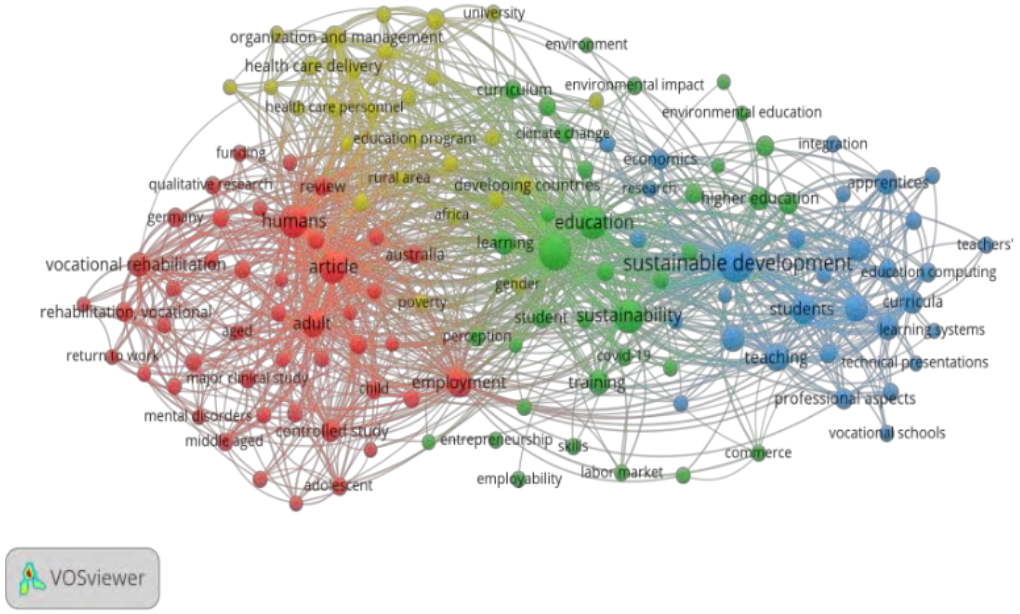
Institution	CoD	Institution	CoD	Institution	CoD
Universitas Pendidikan Indonesia	14	Universitas Indonesia	1	Universiti Utara Malaysia	1
Universitas Negeri Yogyakarta	4	Universitas Gadjah Mada	1	The Australian National University	1
Universiti Malaya	2	Institut Teknologi Bandung	1	National Yunlin University of Science and Technology	1
Brawijaya University	2	Universitas Diponegoro	1	University of Benin	1
Universiti Tun Hussein Onn Malaysia	2	Universitas Padjadjaran	1	Technische Universität Dresden	1
Universitas Negeri Malang	2	Universitas Sebelas Maret	1	Universiti Teknologi Malaysia	1
Universitas Negeri Jakarta	2	Institut Teknologi Sepuluh Nopember	1	Universitas Komputer Indonesia	1
Universitas Negeri Semarang	2	Eastern Visayas State University	1	Universitas PGRI Yogyakarta	1
Astra Manufacturing Polytechnic	1	Universiti Pendidikan Sultan Idris	1	Universitas Sarjanawiyata Tamansiswa	1
Ministry of Education	1	Universitas Islam Sultan Agung Semarang	1	IPMI School of Management	1
University of Indraprasta PGRI	1	Universitas Atma Jaya Yogyakarta	1	ANU College of Business & Economics	1
Universitas Wisnuwardhana Malang	1	Universitas Negeri Surabaya	1	Razak Faculty of Technology and Informatics	1
Politeknik Negeri Balikpapan	1	Universitas Pendidikan Ganesha	1	Universiti Kebangsaan Malaysia	1
UNEVOC Centre at BBPPMPV BMTI	1	Universitas Negeri Makassar	1	Universitas Widyatama	1

3.5. A bibliometric analysis with visualization by VOSviewer

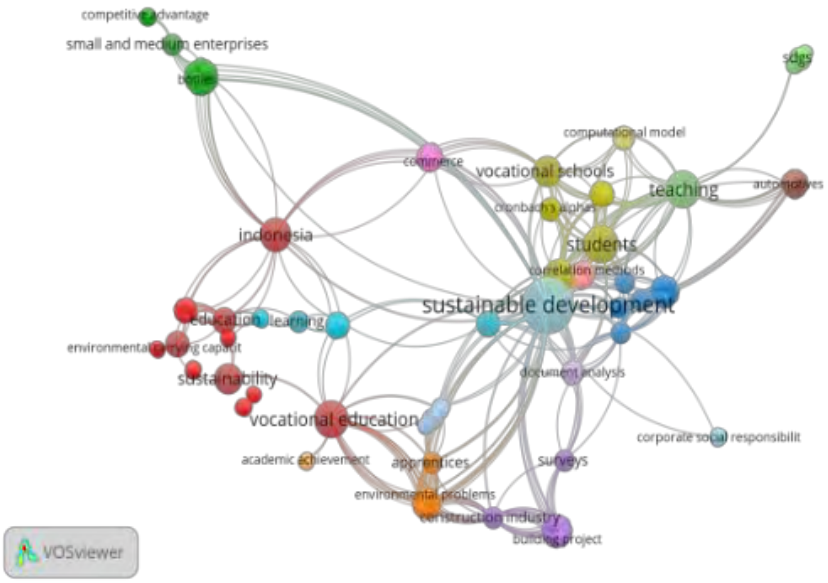
After the search results in the Scopus database are downloaded and exported, they are processed using the VOSviewer application. VOSviewer has excellent visualization and can load and export information from various sources [36]. Data cleaning is an important task that needs to be done during initial processing, so the data will first be checked and cleaned before it is imported into the VOSviewer application. Such as detailed information and duplicate file detection. Network visualization of title, abstract and keywords is shown in Figure 5. Figure 5(a) is a network visualization by all countries documents. The minimum occurrence set at ten times produces 140 terms, divided into 4 clusters with a link strength of 11.318 links. Meanwhile, Figure 5(b) is the network visualization processing on an Indonesia documents, which is set with the minimum occurrence at number 1. This minimum is chosen to make it easier to carry out mapping in relatively few publications. There are a total of 224 keywords divided into 16 clusters with a total link strength of 1.707 links.

By looking at Figure 5(a) and Figure 5(b) the spatial separation of keywords in a cluster indicates the level of connection between these keywords [37], [38]. Correlation can be observed between keywords that are close to each other. Apart from that, the node's size also indicates the frequency of keywords in the literature. A larger node size means a higher occurrence of the corresponding keyword [39]. If we observe the comparison of the complexity of the network visualization in the two images, they are very far apart. Figure 5(a) shows the terms or keywords that appear to have good binding strength. So, it is able to visualize a network of connections that is relatively spread out but close together. The current situation of publications related to sustainability development and TVE in the world has shown rapid progress, namely with the number of terms used to link research in both term. That result differs from Figure 5(b), which shows that the terms that appear tend not to have good binding strength and are also not spread out. This visualization needs

to be clearly visible with the large number of terms that occur and the visual lines that connect them. Then, the location of the clusters is also relatively far apart, indicating that there is still very little research focus on connecting terms.



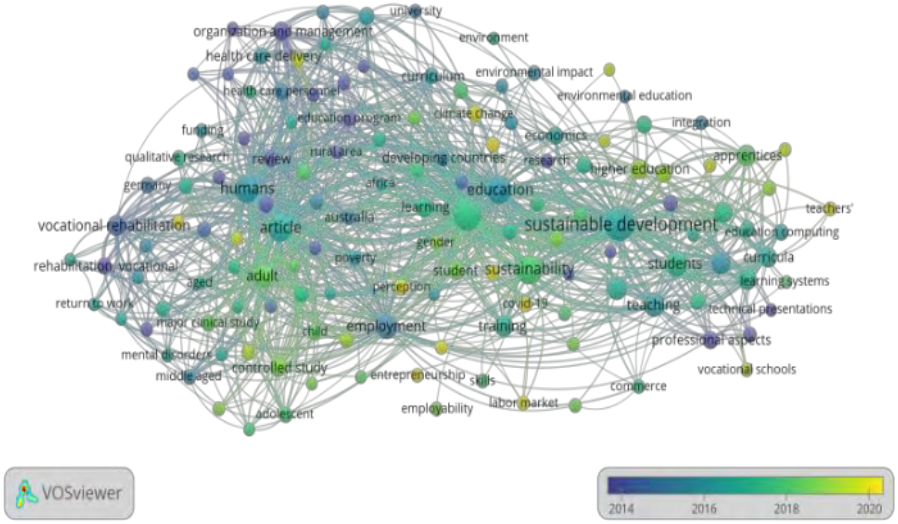
(a)



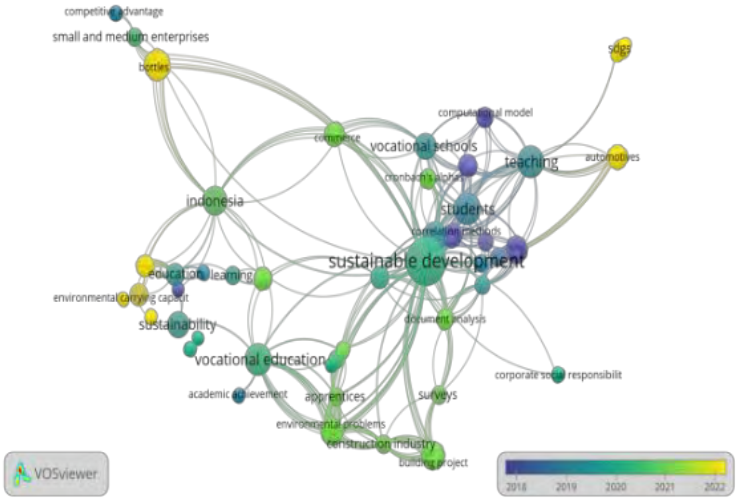
(b)

Figure 5. Network visualization by VOSviewer based on (a) all countries and (b) Indonesia documents

Next, we look at the development of research terms from time to time by looking at the results of overlay visualization in Figure 6. This overlay visualization helps us to visualize a research term/topic by year of publication through color gradients from blue to yellow. The blue color shows the previous year of publication for a particular term. The more yellow the color in the node term, the more recent the year of publication [40]. Figure 6(a) is the overlay visualization for all countries documents, while Figure 6(b) is the overlay visualization for Indonesia documents.



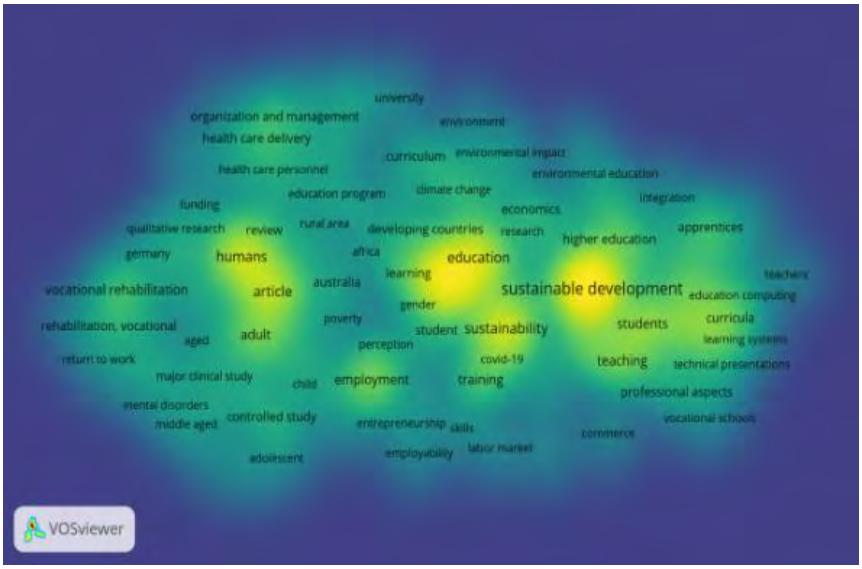
(a)



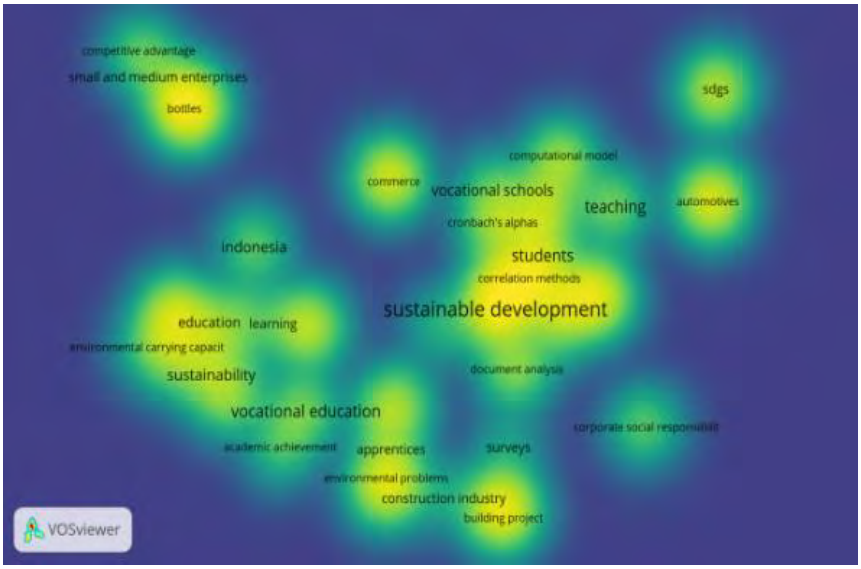
(b)

Figure 6. Overlay visualization by VOSviewer based on (a) all countries and (b) Indonesia documents

The final visualization of VOSviewer is to look at parts of research that are rarely done by looking at density visualization. Density visualization will show density/emphasis in the research group. The results of density visualization show in Figure 7. The color gradation of blue, yellow, and red shows the increasing number of publications in a particular term group [40]. The two images show that no groups of terms are red. Both of them have the highest color gradation, namely yellow. Figure 7(a) is the density visualization for published documents from all countries, visualizing how little research has been conducted on term groups located in peripheral areas. This area is a term for specific keywords. Meanwhile, the term group in the middle tends to be dark yellow in color. It can be assumed that the development of research on sustainability development and TVE topics in the world is no longer discussing big concepts, but has moved to research with specific concepts. Such a visualization is a reasonable projection of development in a research topic area. Meanwhile, in Figure 7(b), it can be seen that the distribution of groups in the research term tends to be evenly colored yellow. Only a few have a shallow depth, which means that research is still rarely carried out. If we refer to the density visualization of all countries, the current results for Indonesia are not good because the resulting density visualization does not project pleasing color gradations, namely from blue to yellow.



(a)



(b)

Figure 7. Density visualization by VOSviewer based on (a) all countries and (b) Indonesia documents

3.6. Discussion

This research conducted a mapping and comparison study by processing publication information on sustainable development on TVE from the Scopus database. Several previous studies [10], [33], [41] has recommended increasing research studies on sustainable development on TVE to contribute to a country towards achieving the SDGs by 2030. The result of this study is a visualization of trends in developing research publications on sustainable development in the scope of TVE throughout the world and Indonesia, and identify the opportunities to improve sustainable development programs through the TVE community in Indonesia.

We have recorded that publications in all countries have been in the Scopus database since 1997 with graphs fluctuating yearly. Then, there has been a drastic increase in publications since 2015. This increase can positively impact the joint agreement regarding SDGs in 2030 in Incheon. Similar findings were also made by Holst *et al.* [42], they found that the implementation of education for sustainable development in Germany gained momentum during the GAP (2015 to 2019). However, there is still a large GAP between countries regarding the number of scientific publications. The occurrence of this inequality is supported by the opinion of Zguir *et al.* [43] that there needs to be more clarity because education for sustainable development (ESD) is not defined as a set of universal and concrete standards used uniformly. Although the

SDGs are not legally binding, a country's government is expected to determine its framework, policies, and actions [19]. Furthermore, the overall VOSviewer visualization results show that research development trends in all countries have succeeded in connecting sustainable development and TVE with the social, economic, and environmental fields. This condition embodies the success of the "transformative TVE" vision in combining economic development, equality/social, and concern for environmental sustainability [44].

Meanwhile, for Indonesia, we noted that Indonesia only issued publications with a total of 42 documents from 2017 to 2024. In fact, the number of Indonesian publications has decreased in the last two years. Even so, Indonesia is still included among the ten countries where most documents originate. The small number of document publications comes from the Institute, and the funding is also small. There are at least 28 institutions affiliated with the publication document. Very few universities in Indonesia still produce research on sustainable development within the scope of TVE, with an average of fewer than three papers. Almost half of the 28 institutions come from outside Indonesia. Apart from that, funding sponsors for research are also very few. There are only three government agencies; the rest are higher education institutions from Indonesia and other countries. Then, through bibliometric visualization results, we found that Indonesia has yet to show the development of research trends in three aspects (social, economic, and environmental). Even if there are, the numbers are still minimal. For example, the researchers noted new topics: small and medium enterprises, bottles, corporate social responsibility, the construction industry, and trade. Apart from that, the emerging issues were dominated by strategies for implementing vocational education, learning, teaching, curriculum, and internships. McGrath and Yamada [10] stated that most published research on TVE in developing countries focuses on practices related to improving classrooms, curricula, and higher education, mainly in the public sector. Although they discuss TVE in a development context, they usually need to answer the question of the relationship between TVE and sustainable development. Implementing sustainable development in the education sector is very dynamic [45]. According to Chen *et al.* [41], research on TVE is at least comprehensive, applied, and educational.

Based on these findings, Indonesia still needs more research publications that can cover various fields of study and are supported by financial guarantees. Increasing sustainability literacy in TVE through literature and implementation research studies is a form of investment to develop a country and an effort to achieve the SDGs. Specifically, there are obstacles in research, namely choosing the type of research, determining a development strategy that involves many parties, and seeking financial support [41]. Collaboration between multiple parties in Indonesia is required to realize how important it is to implement sustainable development in the TVE community. One that can take the first role is higher education institutions. Research conducted by Ferrer-Estévez and Chalmeta [19] shows that since 2015, research on SDGs themes in educational institutions has increased. However, the relevance and impact of research still need to be increased. Its significance must be linked to sustainable development with ethics for all creatures on earth [46]. Therefore, universities should not consider engaging in promoting and implementing SDGs as a burden [47]. Leal Filho *et al.* [48] research shows that universities are highly aware of the SDGs, but only 13% are prioritized. In Indonesia, research conducted by Wijaya and Putri [49] shows that only 10% of state and 24% of private universities provide sustainability courses. This condition could be one of the reasons why the number of higher education publications in Indonesia still needs to be increased. Colleges or universities are essential in creating a pleasant atmosphere that encourages sustainable teaching innovation among academics [50].

This research has several limitations based on the results and discussions described above. This research could not explain comprehensively the topic of sustainable development in TVE. A critical analytical approach focused on techniques and coherent research objectives is required for the future research. Then, even though this research used formal software such as VOSviewer version 1.6.20, Zotero ver. 6.0.30, Google Docs, and Google Sheets, but it is possible that the author made subjective judgments and caused errors. Therefore, the use of alternative application comparisons may be advised.

4. CONCLUSION

The development of research on the topic of sustainable development on TVE in all countries was recorded in the Scopus database from 1997 to 2024, and the trend of increasing the number of new publications began to appear significant in 2015. Meanwhile, for Indonesia, the first publication was only made in 2017. In the 2017 to 2023 period, Indonesia has shown a decline in the number of publications. The countries dominating the document are the United States, China, the United Kingdom, Australia and Germany. Trends in developing research topics for all countries have succeeded in connecting sustainable development and TVE with the social, economic and environmental fields. Indonesia is still dominated by strategic topics for implementing vocational education, learning, teaching, curriculum and internships.

This mapping and comparison study is clearly not aimed at assessing which is better. However, the results of this activity can be used for Indonesia and other countries to improve their publications further in terms of achieving SDGs through TVE. Because, increasing sustainability literacy in TVE through literature and implementation research studies is a form of investment to develop a country. This investment is helpful for preparing people to achieve a prosperous life and compete healthily in the global job market without ignoring global issues for the sake of the common good. The trend of increasing the number of publications by all countries will shows the increasing recognition of efforts to integrate sustainability principles into TVE.

ACKNOWLEDGEMENTS

The authors are grateful to the Ministry of Education and Culture as well as the Institute for Research and Community Service, Sebelas Maret University for the financial support provided to this study and a contract number: 194.2/UN27.22/PT.01.03/2024. The authors are also grateful to the heads of the Mechanical, Building with Informatics, and Computer Engineering Education Study Programs, Sebelas Maret University, for providing communication access to students.

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