A bibliometric analysis of management bioenergy research using vosviewer application

by E S Soegoto

Indonesian Journal of Science & Technology 7(1) (2022) 89-104

Indonesian Journal of Science & Technology

Journal homepage: http://ejournal.upi.edu/index.php/ijost/

A Bibliometric Analysis of Management Bioenergy Research Using Vosviewer Application

Herman Soegoto, Eddy Soeryanto Soegoto, Senny Luckyardi, Agis Abdi Rafdhi*

Universitas Komputer Indonesia, Indonesia
Correspondence: E-mail: senny@email.unikom.ac.id

ABSTRACTS

This study aims at analyzing and demonstrating bibliometric data analysis step by step using VOSViewer systematically. Step-by-step analysis was provided to make first-time users access and utilize VOSViewers more easily. This study provides data analysis regarding management bioenergy and its development throughout five years (2017–2021) by utilizing mapping tools in the VOSViewer. The method used was qualitative descriptive to describe the bibliometric analysis performance by producing network visualization of the chosen topic. From the search results, 1000 relevant published journals were found, ranging from 2017–2021, which were then grouped into five categories according to their published year. After grouping the journal data, we discovered that the total number of articles published on the topic of bioenergy management from 2017 to 2021 was 180. As a result, it conclude that management bioenergy is a field that can be combined with another field to be studied. This way, there is a lot of opportunities to find novelties in this topic. Furthermore, this study is expected to serve as a resource for researchers conducting research and determining the research theme.

ARTICLE INFO

Article History:
Submitted/Received 16 Oct 2021
First revised 27 Nov 2021
Accepted 16 Jan 2022
First available online 17 Jan 2022
Publication date 01 Apr 2022

Keyword:
Bibliometric,
Bioenergy crop,
Management bioenergy,
VOSviewer.

1. INTRODUCTION

As technology grows rapidly, bibliometric analysis that displays mapping tools visually is needed, especially in the field of science. Therefore, software, as the essential component of the modern science ecosystem, that has a scientific purpose application, must be designed to assist with non-trivial scientific tasks. One of a software application that can help scientists as a mapping tool is VOSviewer. In this case, mapping tools are useful to get various information regarding the development of science that has been carried out (Al Husaeni & Nandiyanto, 2022). VOSviewer is a popular software tool that is used to analyze the novelty of research. It also helps to visualize bibliographies (containing title, author, journal, etc.) (Al Husaeni & Nandiyanto, 2022; Van Eck & Waltman, 2017; Hamidah *et al.*, 2020; Mustafa & Erbay, 2020). Bibliography comes from the Ancient Greek words, namely "bilio" (book) and "grafi" (writing). Therefore, a bibliography can be interpreted as a list of articles, books, and magazines that usually present a particular topic (Beebe, 2021; Al-Ashmori, *et al.*, 2020).

VOSviewer software plays an important role in processing data related to data collection, formation, management, analysis, simulation, etc (Mustafa & Erbay, 2020). With this software, scientists can also find novelties in research because this application can represent a certain topic impact. Furthermore, once inputting data, this application is also capable of finding new trends, keywords, as well as the evolutionary process of a certain topic frequency. Furthermore, VOSviewer software is useful for presenting bibliographic visualizations (Al-Ashmori *et al.*, 2020; Orduña-Malea & Costas, 2021). In the world of research, VOSviewer is used for bibliometric analysis, looking for research areas that still have the opportunity to be researched and linked to get updates, as well as looking for library materials that are most widely used in the intended field.

Bioenergy is one of many diverse resources available to assist in meeting our energy demand. It is a type of renewable energy derived from recently living organic materials known as biomass, and it can be used to generate transportation fuels, heat, electricity, and products (Rose *et al.*, 2014). Bioenergy is created by converting biomass into renewable energy that can be used in a variety of applications. Bioenergy will play an important role in the management of global climate change in the future. The majority of the research modelling bioenergy is a transformation of fossil energy into a more environmentally friendly form for daily consumption. Bioenergy use is expected to reach 30% in 2050 and 50% in 2100 and will continue to rise in the future (Rose *et al.*, 2014). In addition to the significance of bioenergy trends, it is necessary to investigate terms in the field of bioenergy management research in order to produce the most recent renewables. Therefore, finding novelties in bioenergy research is important. Thus, we examined management bioenergy research trends and novelty using VOSviewer.

Previous studies regarding VOSviewer in various fields have been conducted. Many papers discussed about bibliometric analysis, such as:

(i) Digital learning (Al Husaeni and Nandiyanto, 2022)
(ii) Computer science (Al Husaeni and Nandiyanto, 2023a)
(iii) Vocational school (Al Husaeni and Nandiyanto, 2023b)
(iv) High school (Al Husaeni and Nandiyanto 2023c)
(v) Covid-19 research (Hamidah et al., 2020)
(vi) Scientific publications (Mulyawati and Ramadhan 2021)
(vii) Chemical engineering (Nandiyanto et al., 2021)

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

(viii) Materials research (Nandiyanto and Al Husaeni, 2021)
(ix) Special needs education (Al Husaeni et al., 2023a)
(x) Publication of techno-economic education (Ragahita and Nandiyanto, 2022)
(xi) Engine performance (Setiyo et al., 2021),
(xii) Dataset portrays decreasing number of scientific publication (Nandiyanto et al., 2020a)
(xiii) Application in robotic hand systems (Castiblanco et al., 2021)
(xiv) Research effectiveness in a subject area among top class universities (Nandiyanto et al., 2020b)
(xv) Educational Research (Al Husaeni et al., 2023b)

Eck and Watman conducted a study regarding VOSviewer as a computer program for bibliometric mapping. They did an analysis regarding the usage of VOSviewer software as well as technical implementation of the software (Van Eck & Waltman, 2010). Van Eck and Watman also used VOSviewer as their research object to indicate research activities at Laiden University. However, they used the VOSviewer 1.4.0 version in their study (Wu *et al.*, 2011). Similar to the previous study, Hu et al. also conducted a study using the VOSviewer software application. In their study, they used VOSviewer to determine which scientists write articles regarding a certain topic (Hu *et al.*, 2019). Meanwhile, Huang et al. also conducted a study regarding the global trend of sacral fracture surgery on VOSviewer (Huang *et al.*, 2020; Gabriella *et al.*, 2021). However, in this study, we used the latest version of VOSviewer, which is 8.0.0, while using management bioenergy as the case study. This study provides a mapping tool not only limited to the trend of chosen topics but also covers the evolutionary process of a certain topic.

The aim of this study is to analyze and demonstrate bibliometric data analysis step by step using VOSViewer systematically. The method used is qualitative descriptive to describe the bibliometric analysis performance by producing network visualization of the chosen topic.

2. METHODS

We used a qualitative descriptive method to describe the data used in this study. We gathered journal data, which is based on research from publications that have been published in Google Scholar-indexed journals. Detailed information on the library quest for searching data is explained in previous studies (Azizah *et al.*, 2021; Al Husaeni & Nandiyanto, 2022). The journal data was related to management bioenergy. To gather the data, we used the reference manager application system as the reference, namely Publish or Perish. In this application, we can choose related articles or journals data from Crossref, Google Scholar, Google Scholar Profile, PubMed, Microsoft Academic, Scopus, and Web of Science. Publish or Perish is used to conduct a literature review of the chosen theme. Therefore, a similar research database was obtained.

Google scholar, in this study, was chosen because it is free to use, unlike Scopus, which publishes or requires a subscription. The journals related to the chosen topic ranged from 2017–2021, and 900 articles were discovered within that period of time. The criteria of the journal are that every journal data must be indexed by Google Scholar and be in compliance with the search for the themes needed in this study, which is management bioenergy. The data is then inputted into VOSviewer. After inputting it, the data is processed so that it can match the desired or chosen keywords. Furthermore, VOSviewer then converted the inputted data into an interconnected data map.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

Furthermore, we examined the difference in the number of publications each year and classify the 15 articles with the highest number of citations for each publisher from a total of 1000 articles.

3. RESULTS AND DISCUSSION

Based on data obtained from a search using the Publish and Perish software, 1000 articles on the topic of bioenergy management published in journals between 2017 and 2021 were discovered. Every year, articles on bioenergy are fairly evenly distributed. From 2017 to 2021, the number of published journals was 181, 157, 200, 198, and 162, respectively.

Table 1 displays the data for the most cited articles in the field of bioenergy management. The number of research topic keywords that can be linked to VOSviewer was limited to two. Following that, a data set of research articles was gathered in order to analyze the relationship between the terms.

The data obtained on the topic of bioenergy management was divided into seven clusters, namely:

(i) Cluster 1 has 33 items, the 33 items are bio, bioenergy feedstock production, biogas production, carbon capture, circular economy, comprehensive review, effective waste management, energy recovery, environmental performance, food waste, forest, ghg emission, greenhouse gas emission, improvement, land use, life cycle assessment, manure management, measure, mitigation, municipal solid waste, municipal solid waste management, reduction, solid waste management, suitability, sustainable bioenergy, sustainable development, sustainable forest management, transition, uncertainty, valorisation, waste management system, and wood.

(ii) Cluster 2 has 22 items, the 22 items are agricultural waste, bioenergy recovery, biofuel production, carbon, crop residue, efficient management, enhancement, feedstock, form, fossil fuel, fuel, heat, heavy metal, lignocellulosic biomass, management option, methane, nanotechnology, pretreatment, pyrolysis, renewable energy, risk management, and waste water treatment.

(iii) Cluster 3 has 17 items, the 17 items are base management practice, bioenergy potential, biomass yield, effectiveness energy management, engineering, fertilizer, interaction, miscanthus, nutrient management, nutrient management practice, perennial bioenergy crop, present study, quality, risk, science, and variety.

(iv) Cluster 4 has 14 items, the 14 items are availability, bioenergy crop, bioenergy purpose, bioenergy supply chance, evident, farmer, food, forage, harvest, implication, marginal land, sugarcane, and switchgrass.

(v) Cluster 5 14 items, the 14 items are bioenergy feed stock, bioenergy yield, corn, corn stover, crop, crop management, nitrogen, nitrogen management, residue management, soil carbon, sweet sorghum, tillage, united states, and yield.

(vi) Cluster 6 has 11 items, the 11 items are agricultural management, biodiesel, biomass production, data, environmental assessment, gasification, land, microalgae, soil management, sustainable energy, and transportation.

(vii) Cluster 7 has 11 items, the 11 items are biodiversity, bioenergy production system, bioenergy sector, climate change, ecosystem service, farm, framework, green supply change management, information, policy, and proper management.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

Table 1. The most cited articles of bioenergy management.

No	Cites	Title	Source	Year
1	277	A state-of-art literature review reflecting 15 years of focus on sustainable supply chain management (Ansari & Kant, 2017)	Journal of cleaner production	2017
2	233	Supply chain risk management and artificial intelligence: state of the art and future research directions (Baryannis *et al.*, 2019)	International Journal of Production Research	2019
3	178	Improved light-harvesting and thermal management for efficient solar-driven water evaporation using 3D photothermal cones (Wang *et al.*, 2018)	Journal of Materials	2018
4	175	Constructed floating wetlands: a review of research, design, operation and management aspects, and data meta-analysis (Pavlineri *et al.*, 2017)	Chemical Engineering Journal	2017
5	175	Volatile fatty acids production from food wastes for biorefinery platforms: A review (Strazzera *et al.*, 2018)	management	2018
6	140	Tillage, crop residue, and nutrient management effects on soil organic carbon in rice-based cropping systems: A review (Ghimire *et al.*, 2017)	Journal of integrative	2017
7	134	Biochar for environmental management: Mitigating greenhouse gas emissions, contaminant treatment, and potential negative impacts (Zhang *et al.*, 2019)	Engineering Journal	2019
8	132	Information systems and sustainable supply chain management towards a more sustainable society: Where we are and where we are going (de Camargo Fiorini & Jabbour, 2017)	Journal of Information Management	2017
9	128	Municipal wastewater sludge as a sustainable bioresource in the United States (Seiple *et al.*, 2017)	of Environmental Management	2017
10	127	Biochar as a tool to reduce the agricultural greenhouse-gas burden"knowns, unknowns and future research needs (Kammann *et al.*, 2017)	Management	2017
11	126	International evolution of fat, oil and grease (FOG) waste management"A review (Wallace *et al.*, 2017)	environmental management	2017
12	103	Methods for determination of biomethane potential of feedstocks: a review (Jingura & Kamusoko, 2017)	Biofuel Research Journal	2017
13	102	Management and control of microbiologically influenced corrosion (MIC) in the oil and gas industry"Overview and a North Sea case study (Skovhus *et al.*, 2017)	Journal of biotechnology	2017
14	95	Optimizing management to enhance multifunctionality in a boreal forest landscape (Triviño *et al.*, 2017)	Journal of Applied	2017
15	89	Potential for using municipal solid waste as a resource for bioenergy with carbon capture and storage (BECCS) (Pour *et al.*, 2018)	International Journal of Greenhouse Gas	2018

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

The link between the terms is depicted in **Figure 1**. In the network visualization, relationships are represented by a network or line that connects one term to another (Al Husaeni & Nandiyanto, 2023).

The clusters in each of the examined issue areas are depicted in **Figure 1**. Other terms are most closely connected to the study keyword.

Cluster 1, which contained 33 items, contained the study's keywords. There were 122 links in the keyword study. The link between terms was visualized overlaid with the date the study was updated (Al Husaeni & Nandiyanto, 2022).

Figure 2 depicts the trend in bioenergy management research from year to year. Bioenergy research based on **Figure 2** took place between 2017 and 2021. The density visualization in **Figure 3** shows that the darker the yellow color and the larger the width of the circle, the denser the keywords, indicating that research on this topic was becoming more common. The number of studies was reduced if the color faded and mixed into the green background.

Each Cluster contained a relationship between two terms. Forest was the most commonly used term in Cluster 1 as a research topic for bioenergy management.

According to **Figure 4**, forests are linked to 15 other terms. Policy, bioenergy sector, land, improvement, heat, harvest, life cycle assessment, ghg emission, wood, mitigation, reduction, and uncertainty are all terms related to forest keywords. Carbon was the most widely discussed term in the field of bioenergy management in Cluster 2. Carbon was linked to 16 other terms in **Figure 5**. Policy, availability, land, pyrolysis, food waste, feedstock, biomass production, switchgrass, farm, valorisation, forest, information, mitigation, corn, residue management, and nitrogen were all terms related to the keyword carbon.

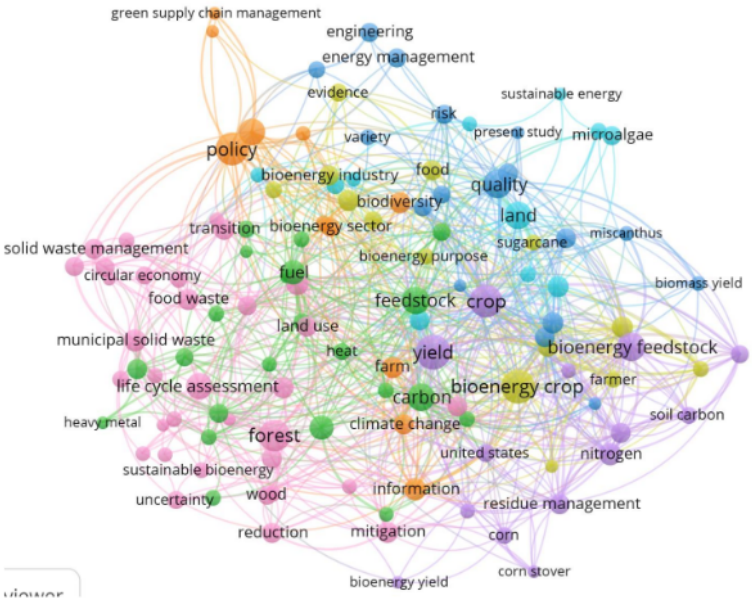

Figure 1. Network visualization of management bioenergy.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

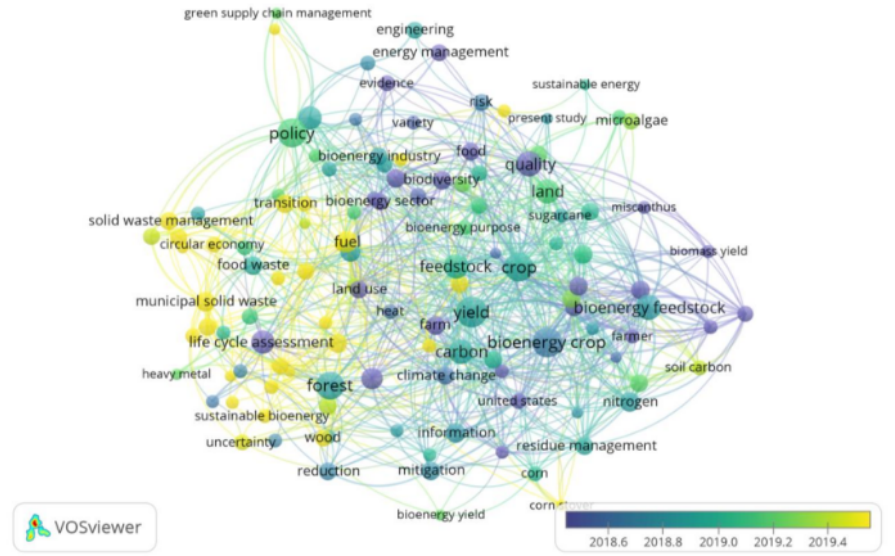

Figure 2. Overlay visualization of management bioenergy.

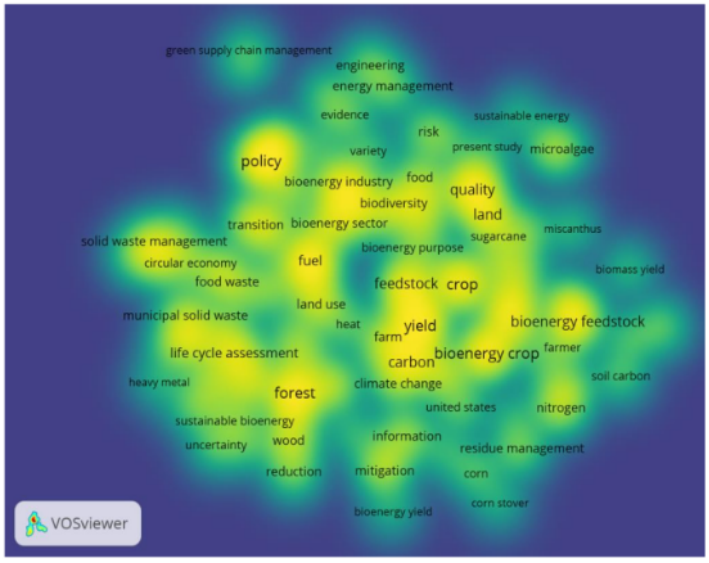

Figure 3. Density visualization of management bioenergy.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

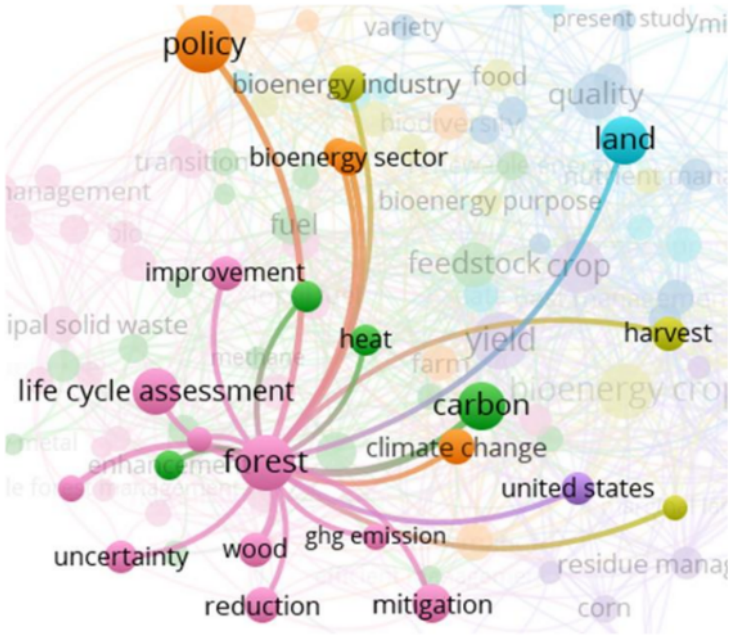

Figure 4. Network visualization of cluster 1.

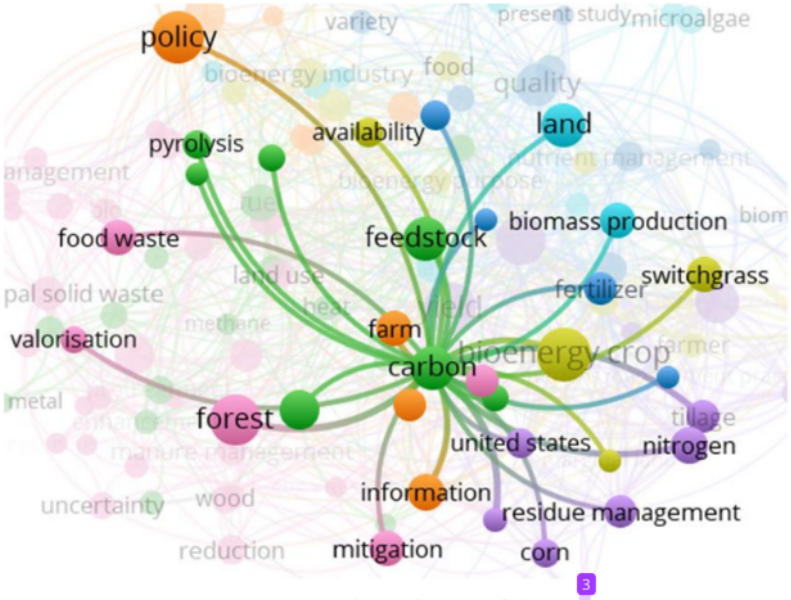

Figure 5. Network visualization of cluster 2.

DOI: http://doi.org/10.17509/ijost.v7i1.43328
p- ISSN 2528-1410 e- ISSN 2527-8045

In Cluster 3, quality was at the centre of the term that was most commonly used as a research topic for bioenergy management and had numerous connections with other terms. According to the graph, quality was linked to 15 other terms (see **Figure 6**). Evidence, risk, variety, gasification, policy, measure, land use, feedstock, biomass production, nutrient management, biomass yield, yield, bioenergy crop, bioenergy feedstock, and residue management were all quality keywords.

Meanwhile, in Cluster 4, the bioenergy crop became the main centre of the term that was most frequently raised as a topic of research on bioenergy management and had numerous connections with other terms. **Figure 7** depicts the relationship between bioenergy and other words. **Figure 7** depicts the relationship between bioenergy crops and 27 other crops. **Figure 7** shows how bioenergy crops were linked to 27 other concepts. Risk, bioenergy industry, food, biodiversity, quality, land, surgance, crop, miscanthus, biomass yield, bioenergy feedstock, farmer, soil carbon, nitrogen, corn, nitrogen management, mitigation, information, climate change, carbon, farm, yield, land use, reduction, enhancement, biofuel production, and heavy metal.

In Cluster 5, yield was the centre point of the term that was most widely used as a research topic for bioenergy management and had numerous connections to other terms.

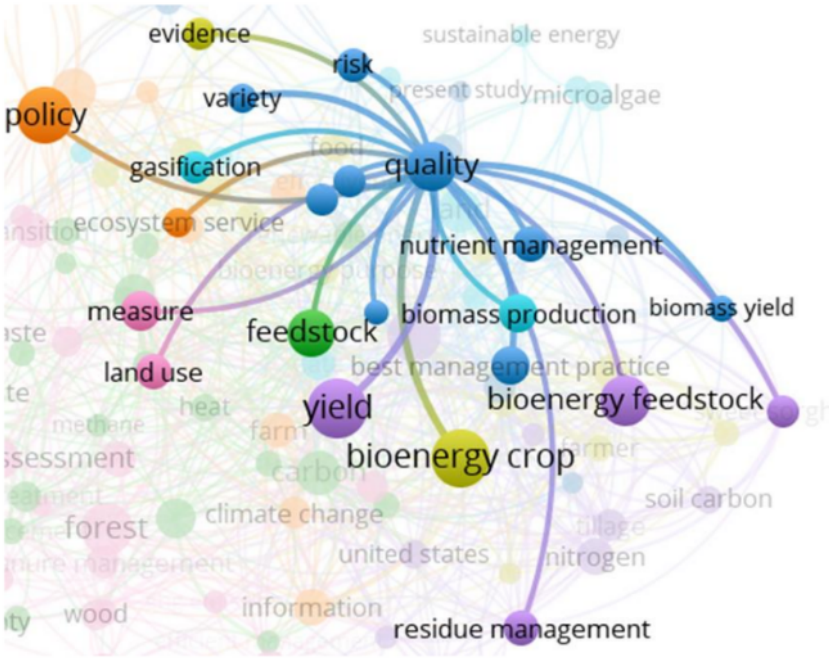

Figure 6. Network visualization of cluster 3.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

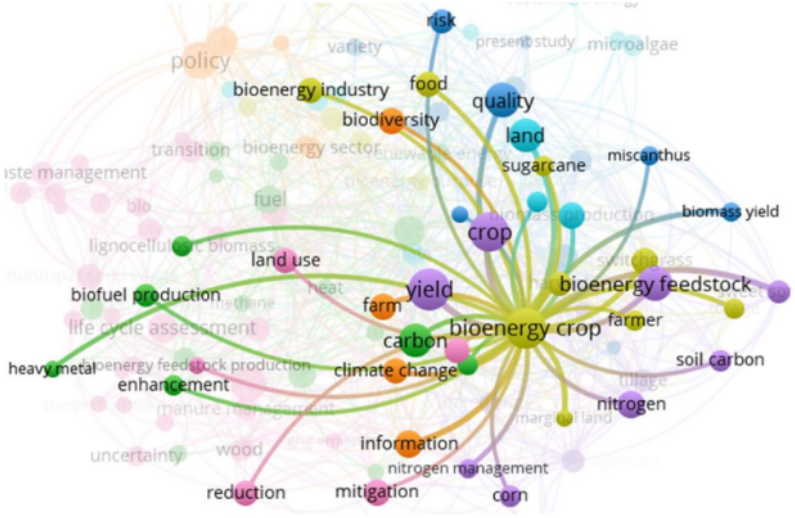

Figure 7. Network visualization of cluster 4.

According to the **Figure 8**, yield was linked to 22 other terms. Risk, current study, quality, implication, bioenergy sector, nutrient management, crop, feedstock, land use, biofuel production, sustainable bioenergy, uncertainty, reduction, climate change, information, mitigation, corn, residue management, corn stover, bioenergy crop, tillage, and bioenergy feedstock were all terms related to yield keywords. In cluster 6, land was the center point of the term that was most frequently used as a research topic for bioenergy management and had numerous connections to other terms. According to **Figure 9**, land was linked to 14 other terms.

Sustainable energy, biodiesel, framework, bioenergy potential, biodiversity, pyrolysis, land use, data, crop, forest, bioenergy crop, bioenergy feedstock, biomass yield, and nitrogen were all terms related to land. Meanwhile, in Cluster 7, policy becomes the focal point of the term that was most widely used as a research topic on bioenergy management and had many connections to other terms.

Figure 10 depicts the relationship between policy and other words. **Figure 10** depicts the relationship between policy and ten other concepts, including green supply chain management, energy management, quality, biodiversity, transition, land use, food waste, life cycle assessment, carbon, and forest.

Above clusters explained the network connection among keywords. This is important for understanding how the results have relation for practitioners to do more research. Indeed, this can be used for further developments.

Bioenergy based on bioresources is the right choice that can be utilized today. Indonesia is rich in potential bioresources. The biggest challenge today is conducting low-cost biological resource research to accelerate their commercialization and utilization. With bibliometric analysis, we will be able to map research in the field of bioenergy that contributes to the provider of bio-hydrogen-producing bio-resource-based fuels. In fact, we can develop novelty in research based on relevant links between sub-fields of science that can be analyzed using bibliometric techniques.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

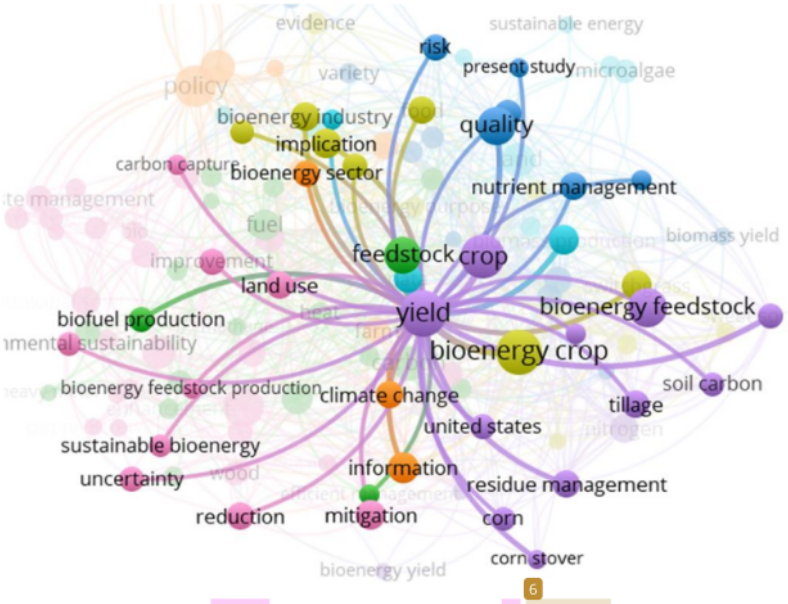

Figure 8. Network visualization of cluster 5.

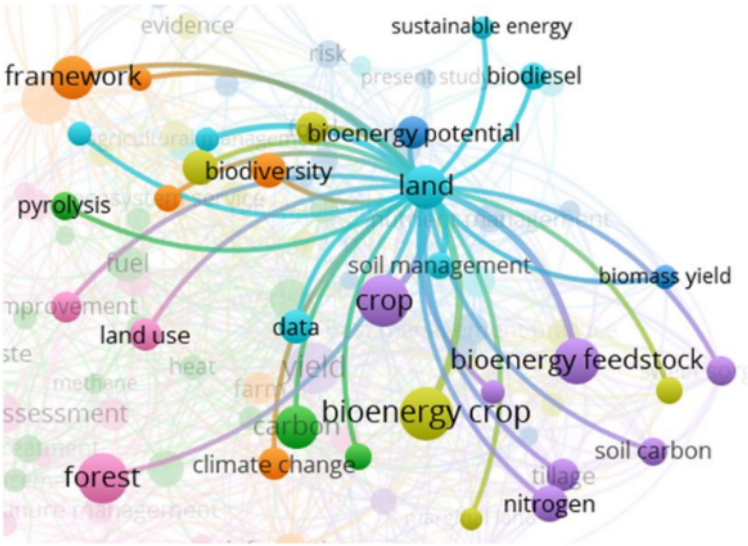

Figure 9. Network visualization of cluster 6.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

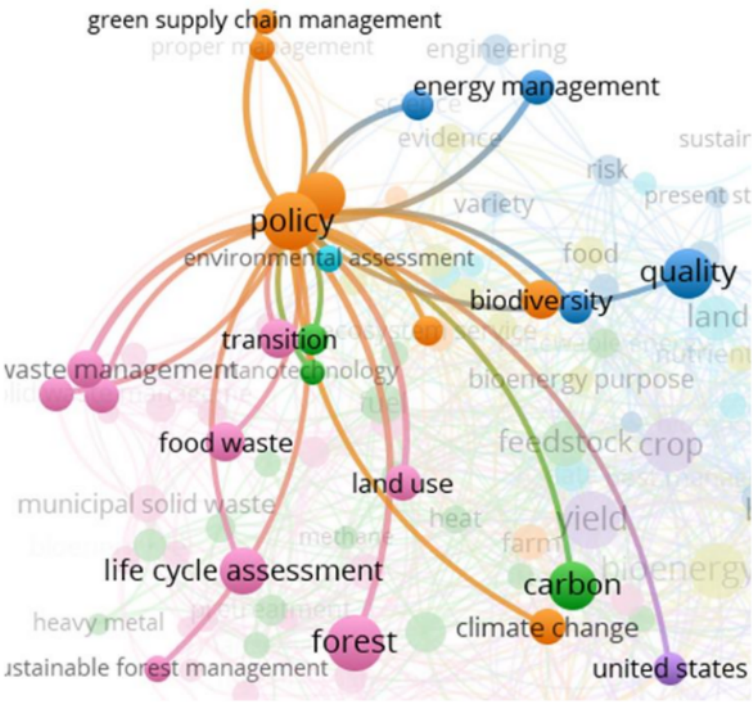

Figure 10. Network visualization of cluster 7.

4. CONCLUSION

The purpose of this research was to examine the bibliometric literature on bioenergy management. In this study, bioenergy was divided into two categories: bioenergy crops and bioenergy feedstock. In the search process, the keyword "management bioenergy" was used, which was based on a topic area with titles, keywords, and abstracts. Following the search, 900 articles were discovered to be relevant. The mapping procedure was then completed using VOSviewer. The search yielded 15 papers with the most citations. Based on the results of analysis and mapping with VOSviewer, bioenergy management research with term study was identified as the most studied in the 2017–2021 period. Meanwhile, the bioenergy crop was the most researched in the field of bioenergy management. The VOSviewer analysis identified seven keyword Clusters related to the research topic of bioenergy management. Each Cluster contains a main term that was linked to other terms. Forest, Carbon, Quality, Bioenergy Crop, Yield, Land, and Policy were all terms found in Cluster 1. Meanwhile, for Cluster 2-7, the terms included were forest, Quality, Bioenergy Crop, Yield, Land, and Policy, respectively.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

6. REFERENCES

Al Husaeni, D. F., and Nandiyanto, A. B. D. (2022). Bibliometric using Vosviewer with Publish or Perish (using google scholar data): From step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post Covid-19 pandemic. *ASEAN Journal of Science and Engineering*, *2*(1), 19-46.

Al Husaeni, D. F., and Nandiyanto, A. B. D. (2023a). Mapping visualization analysis of computer science research data in 2017-2021 on the google scholar database with vosviewer. *International Journal of Informatics Information System and Computer Engineering*, *3*(1), 1-18.

Al Husaeni, D. N., and Nandiyanto, A. B. D. (2023b). A bibliometric analysis of vocational school keywords using vosviewer. *ASEAN Journal of Science and Engineering Education, 3*(1), 1-10.

Al Husaeni, D. N., and Nandiyanto, A. B. D. (2023c). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, 3(1), 1-12.

Al Husaeni, D. N., Nandiyanto, A. B. D., and Maryanti, R. (2023a). Bibliometric analysis of special needs education keyword using vosviewer indexed by google scholar. *Indonesian Journal of Community and Special Needs Education, 3*(1), 1-10.

Al Husaeni, D.F., Nandiyanto, A.B.D., and Maryanti, R. (2023b). Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research. *Indonesian Journal of Teaching in Science, 3*(1), 1-8.

Al-Ashmori, Y. Y., Othman, I., and Rahmawati, Y. (2020, April). Bibliographic analysis of BIM success factors and other BIM literatures using Vosviewer: A theoretical mapping and discussion. *Journal of Physics: Conference Series. 1529*(4), 1-9.

Ansari, Z. N., and Kant, R. (2017). A state-of-art literature review reflecting 15 years of focus on sustainable supply chain management. *Journal of Cleaner Production*, *142*, 2524-2543.

Azizah, N. N., Maryanti, R., and Nandiyanto, A. B. D. (2021). How to search and manage references with a specific referencing style using google scholar: From step-by-step processing for users to the practical examples in the referencing education. *Indonesian Journal of Multidiciplinary Research*, *1*(2), 267-294.

Baryannis, G., Validi, S., Dani, S., and Antoniou, G. (2019). Supply chain risk management and artificial intelligence: state of the art and future research directions. *International Journal of Production Research*, *57*(7), 2179-2202.

Beebe, N. H. (2021). A complete bibliography of publications in the journal of statistical theory and practice. *Algorithms*, *630*(723), 208.

Castiblanco, P. A., Ramirez, J. L., and Rubiano, A. (2021). Smart materials and their application in robotic hand systems: A state of the art. *Indonesian Journal of Science and Technology, 6*(2), 401-426.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

de Camargo Fiorini, P., and Jabbour, C. J. C. (2017). Information systems and sustainable supply chain management towards a more sustainable society: Where we are and where we are going. *International Journal of Information Management*, *37*(4), 241-249.

Gabriella, R., Zen, M. A. N., Haq, F. I., Putri, S. R., and Nandiyanto, A. B. D. (2021). Techno-economic analysis of nife2o4 nanoparticle industry using sonochemical synthesis method. *International Journal of Research and Applied Technology (INJURATECH).* 1(2), 65-75.

Ghimire, R., Lamichhane, S., Acharya, B. S., Bista, P., and Sainju, U. M. (2017). Tillage, crop residue, and nutrient management effects on soil organic carbon in rice-based cropping systems: A review. *Journal of Integrative Agriculture*, *16*(1), 1-15.

Hamidah, I., Sriyono, S., & Hudha, M. N. (2020). A Bibliometric analysis of Covid-19 research using VOSviewer. *Indonesian Journal of Science and Technology*, *5*(2), 209-216.

Hu, Y., Sun, Z., and Wu, D. (2019). Analysis of hot topics in soil remediation research based on VOSviewer. *IOP Conference Series: Earth and Environmental Science, 300*(3), 032098

Huang, T., Wu, H., Yang, S., Su, B., Tang, K., Quan, Z., and Luo, X. (2020). Global trends of researches on sacral fracture surgery: A bibliometric study based on VOSviewer. *Spine*, *45*(12), E721-E728.

Jingura, R. M., and Kamusoko, R. (2017). Methods for determination of biomethane potential of feedstocks: a review. *Biofuel Research Journal*, *4*(2), 573-586.

Kammann, C., Ippolito, J., Hagemann, N., Borchard, N., Cayuela, M. L., Estavillo, J. M., and Wrage-Mönnig, N. (2017). Biochar as a tool to reduce the agricultural greenhouse-gas burden–knowns, unknowns and future research needs. *Journal of Environmental Engineering and Landscape Management*, *25*(2), 114-139.

Mulyawati, I. B., & Ramadhan, D. F. (2021). Bibliometric and visualized analysis of scientific publications on geotechnics fields. *ASEAN Journal of Science and Engineering Education*, *1*(1), 37-46.

Mustafa, K. A. Y. A., and ERBAY, E. (2020). Global trends of the researches on Covid-19: A bibliometric analysis via VOSviewer. *Ankara Sağlık Bilimleri Dergisi*, *9*(2), 201-216.

Nandiyanto, A. B. D., Al Husaeni, D. N., and Al Husaeni, D. F. (2021). A bibliometric analysis of chemical engineering research using vosviewer and its correlation with covid-19 pandemic condition. *Journal of Engineering Science and Technology*, *16*(6), 4414-4422.

Nandiyanto, A. B. D., and Al Husaeni, D. F. (2021). A bibliometric analysis of materials research in Indonesian journal using VOSviewer. *Journal of Engineering Research*. *9*(ASSEEE Special Issue), 1-16.

Nandiyanto, A. B. D., Biddinika, M. K., and Triawan, F. (2020a). How bibliographic dataset portrays decreasing number of scientific publication from Indonesia. *Indonesian Journal of Science and Technology, 5*(1), 154-175.

Nandiyanto, A. B. D., Biddinika, M. K., and Triawan, F. A. R. I. D. (2020b). Evaluation on research effectiveness in a subject area among top class universities: a case of Indonesia's academic publication dataset on chemical and material sciences. *Journal of Engineering Science and Technology, 15*(3), 1747-1775.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

Orduña-Malea, E., and Costas, R. (2021). Link-based approach to study scientific software usage: The case of VOSviewer. *Scientometrics*, *126*(9), 8153-8186.

Pavlineri, N., Skoulikidis, N. T., and Tsihrintzis, V. A. (2017). Constructed floating wetlands: a review of research, design, operation and management aspects, and data meta-analysis. *Chemical Engineering Journal*, *308*, 1120-1132.

Pour, N., Webley, P. A., and Cook, P. J. (2018). Potential for using municipal solid waste as a resource for bioenergy with carbon capture and storage (BECCS). *International Journal of Greenhouse Gas Control*, *68*, 1-15.

Ragahita, R., and Nandiyanto, A. B. D. (2022). Computational Bibliometric Analysis on Publication of Techno-Economic Education. *Indonesian Journal of Multidiciplinary Research, 2*(1), 213-220.

Rose, S. K., Kriegler, E., Bibas, R., Calvin, K., Popp, A., van Vuuren, D. P., and Weyant, J. (2014). Bioenergy in energy transformation and climate management. *Climatic Change*, *123*(3), 477-493.

Seiple, T. E., Coleman, A. M., and Skaggs, R. L. (2017). Municipal wastewater sludge as a sustainable bioresource in the United States. *Journal of Environmental Management*, *197*, 673-680.

Setiyo, M., Yuvenda, D., and Samue, O. D. (2021). The Concise latest report on the advantages and disadvantages of pure biodiesel (B100) on engine performance: Literature review and bibliometric analysis. *Indonesian Journal of Science and Technology, 6*(3), 469-490.

Skovhus, T. L., Eckert, R. B., and Rodrigues, E. (2017). Management and control of microbiologically influenced corrosion (MIC) in the oil and gas industry—Overview and a North Sea case study. *Journal of biotechnology*, *256*, 31-45.

Strazzera, G., Battista, F., Garcia, N. H., Frison, N., and Bolzonella, D. (2018). Volatile fatty acids production from food wastes for biorefinery platforms: A review. *Journal of Environmental Management*, *226*, 278-288.

Triviño, M., Pohjanmies, T., Mazziotta, A., Juutinen, A., Podkopaev, D., Le Tortorec, E., and Mönkkönen, M. (2017). Optimizing management to enhance multifunctionality in a boreal forest landscape. *Journal of Applied Ecology*, *54*(1), 61-70.

Van Eck, N. J., and Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523-538.

Van Eck, N. J., and Waltman, L. (2017). Citation-based clustering of publications using CitNetExplorer and VOSviewer. *Scientometrics*, *111*(2), 1053-1070.

Wallace, T., Gibbons, D., O'Dwyer, M., and Curran, T. P. (2017). International evolution of fat, oil and grease (FOG) waste management–A review. *Journal of environmental management*, *187*, 424-435.

Wang, Y., Wang, C., Song, X., Huang, M., Megarajan, S. K., Shaukat, S. F., and Jiang, H. (2018). Improved light-harvesting and thermal management for efficient solar-driven water evaporation using 3D photothermal cones. *Journal of Materials Chemistry A*, *6*(21), 9874-9881.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

Wu, T., Mayaffre, H., Krämer, S., Horvatić, M., Berthier, C., Hardy, W. N., and Julien, M. H. (2011). Magnetic-field-induced charge-stripe order in the high-temperature superconductor YBa 2 Cu 3 O y. *Nature*, *477*(7363), 191-194.

Zhang, C., Zeng, G., Huang, D., Lai, C., Chen, M., Cheng, M., and Wang, R. (2019). Biochar for environmental management: Mitigating greenhouse gas emissions, contaminant treatment, and potential negative impacts. *Chemical Engineering Journal*, *373*, 902-922.

DOI: http://doi.org/10.17509/ijost.v7i1
p- ISSN 2528-1410 e- ISSN 2527-8045

A bibliometric analysis of management bioenergy research using vosviewer application

ORIGINALITY REPORT

10%	6%	6%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Camarines Sur Polytechnic Colleges Student Paper	2%
2	Submitted to Liverpool John Moores University Student Paper	2%
3	Submitted to Nilai University College Student Paper	2%
4	doaj.org Internet Source	2%
5	ouci.dntb.gov.ua Internet Source	1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		