

BIBLIOMETRIC ANALYSIS OF ENGINEERING RESEARCH USING VOSVIEWER INDEXED BY GOOGLE SCHOLAR

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Abstract

Engineering is a discipline that can help in solving human problems in their daily lives. Currently, a lot of engineering research has been done. The purpose of this research is to perform bibliometric analysis of bibliographic data of engineering research articles indexed by google scholar by combining analysis in terms of the distribution of bibliometric maps using VOSviewer software. The research data was obtained from the Google Scholar database which was obtained through the Publish or Perish references manager application. The data filtering process is carried out based on the keyword "engineering" contained in the topic, title, keyword, and abstract areas. The search was conducted for articles published in the 2017-2021 range. From the search results obtained 1000 relevant articles. The results show that engineering research has decreased over the last 5 years, namely in 2017 amounting to 396 to 14 articles in 2021. Research related to engineering is the most widely researched term engineering itself. Meanwhile, the least is in terms of the environment. The research that has the highest up-to-date on engineering keywords is computer science. Each data and research result are obtained based on the results of mapping analysis using VOSviewer. This review is certainly expected to provide a point of reference and consideration in seeking further research fields, especially research related to engineering.

Keywords: Bibliometric, Data analysis, Engineering, Google Scholar, Mapping data, VOSviewer.

1. Introduction

Engineering is a discipline that is very important for human life. Engineering is a science that helps humans in overcoming the problems they face [1]. Engineering is an applied engineering discipline based on the application of a scientific and mathematical theory to modern human solutions in everyday life. Engineering is more often used in human life in an environment with such high technological developments as it is today. Engineering research is growing rapidly. There is one analysis that can be used to determine the development of research on engineering, namely bibliometric analysis.

Bibliometric analysis can assist researchers in studying bibliographic content, citation analysis of each article published in journals and other scientific writings. Bibliographies that can be used in the bibliometric analysis include the type of publication, the research topic area, the country of origin of the researcher, the journal in which it is published, and the language used in the article [2]. Bibliometric analysis can also be said as a quantitative method for analysing bibliographic data listed in the article. The bibliometric method is a method of measuring the literature using a statistical approach. Bibliometric analysis is a method that is considered effective in providing data sets that can be utilized in improving the quality of research [3].

There have been many studies that discuss bibliometric analysis. Hamidah et al. [2], has researched the use of bibliometric analysis methods in research on Covid-19, research conducted by Ho [4], bibliometric analysis on big data medical research, and research conducted by Noor et al. [5] regarding bibliometric analysis of social media as a medium of knowledge about management. In addition to these studies, there are many other studies related to bibliometric analysis including bibliometric analysis research on Scopus indexed research themes [6], smart cities research [7], economics research [8], techniques in public health search [9], management [10] and marketing research [11].

However, there has been no research on bibliometric analysis in the field of engineering research on articles published in journals indexed by Google Scholar by utilizing VOSviewer software as a tool in conducting mapping analysis, so that it can determine the quantity and up-to-date of a term. Therefore, this study was conducted to conduct a bibliometric engineering research article indexed by google scholar by combining mapping analysis in terms of the distribution of bibliometric maps using VOSviewer software. This research is expected to help and become a reference for researchers in conducting and determining the research themes to be taken, especially those related to the engineering field.

The motivation of this study is to conduct bibliometric analysis through mapping visualization of engineering research. Thus, we can find out the relationship between engineering research and other disciplines. In addition, we can also find out the latest research in engineering.

The novelties of this research are (i) bibliometric analysis was carried out in the field of engineering research published in journals on the google scholar database, (ii) bibliometric analysis was carried out using the mapping visualization method, and (iii) VOSviewer application was used as a tool in conducting mapping analysis.

2. Literature Review

VOSViewer is an application or computer program developed to create, construct, and display bibliometric maps [12]. VOSViewer also has several features offered,

one of which is a text-mining function that can be used to build and visualize co-relationships in citing an article [13]. Mapping system zoom, searching, and scrolling can be used to display publication maps [14]. Therefore, the mapping of the articles can be more detailed. VOSviewer can represent information specifically about bibliometric graphic maps [15].

VOSViewer is widely used in analysing the position of research conducted to measure the novelty of the research [16]. VOSviewer can be used in interpreting research relationships displayed in bibliometric maps [17]. VOSViewer can map various types of bibliometric analysis, supports various major bibliographic databases, and is intended for text processing functions [18]. In addition, VOSviewer can also be used in mapping using model and cluster layout techniques. VOSviewer can visualization mapping data through various visualizations such as overlay and density [19].

VOSviewer can extract bibliometric analysis, which is used to summarize large data by analysing the bibliometric data of the study [20]. Bibliometrics presents the intellectual structure and emerging trends of a topic or area of research [21]. Bibliometric analysis can be used to analyse big data. The bibliometric analysis uses quantitative (evaluation and interpretation) and qualitative (interpretation only) approaches [22].

One of the important subjects is engineering. Engineering science is a scientific field that combines science and technology to produce solutions to human problems within the scope of engineering studies [23]. Engineering science is included in the natural sciences group because its field of study applies natural sciences such as chemistry, physics, biology, and mathematics. Engineering science develops along with the progress of human civilization, as evidenced by the many studies that have been carried out on engineering [24-37]. Engineering research is a field of research that seeks an improvement in theory and practice in certain fields, such as high-speed computing, biotechnology, earthquake prediction, power systems, nanotechnology, and construction [38]. In the engineering field, researchers design, calculate, and do plan a particular technology.

3.Method

The data articles used in this study are research data that have been published in Google Scholar indexed journals. The data were obtained by using the reference managers application. Publish or perish is a reference manager's application used in research. Publish or perish is used in conducting a literature review of the themes we take. We took data from the google scholar database. The type of article that we take is the type of article published in a journal. Every article data indexed by Google Scholar and in the type of journal articles and having conformity with the search for the themes needed in this study are backed up into a file that is used in using VOSviewer.

In this study, we filtered articles related only to Engineering. We search for data on publishing or perish by entering the keyword "Engineering" according to the title, keyword, and abstract criteria. Thus, 1000 articles were obtained which were assessed according to the chosen theme. The articles used in this study are articles published in the 2017-2021 range. The articles that have been collected are then saved in *.RIS format. Next, we use the VOSviewer application to visualize and analyse trends in the form of bibliometric maps. We do data mapping articles from database sources that have been prepared. Data mapping consists of three types, namely network, density, and visualization overlay.

VOSviewer is used for mapping analysis of publications, countries, and journals based on co-citation and based on keywords that are visualized on a network of relationships between existing terms. At the time of making the bibliometric map, the keyword frequency is set to at least 5 times found or appearing in the prepared database. In addition, we also filter the terms that will be included in the VOSviewer network mapping visualization.

4. Result and Discussion

3.1. Research Developments in the Field of Engineering

Table 1 shows the development of research in the field of Engineering published in Google Scholar indexed journals. Based on the data shown in Table 1, it can be seen that the number of researches on digital engineering is 1000 articles from 2017-2021. In 2017 there were 396 articles. In 2018 there were 351 articles regarding the engineering field. In 2019 there were 187 articles, in 2020 there were 52 articles and in 2021 there were 14 articles.

Table 1. Development of engineering research.

No.	Years	Total per year
1	2017	396
2	2018	351
3	2019	187
4	2020	52
5	2021	14
Total		1000

Figure 1 shows a depiction of the growth or development of research in the field of engineering each year. Based on Fig. 1, it is known that the development of research related to Engineering has decreased in the last 5 years. This is shown by the number of articles in 2017 as many as 396 articles, which continued to decline until it decreased by 382 articles in 2021 to 14 articles. A very significant decrease occurred from 2018 to 2019 were from the total number of research articles 351 in 2018 to 187 in 2019. This shows a decline of 164 articles between 2018 and 2019.

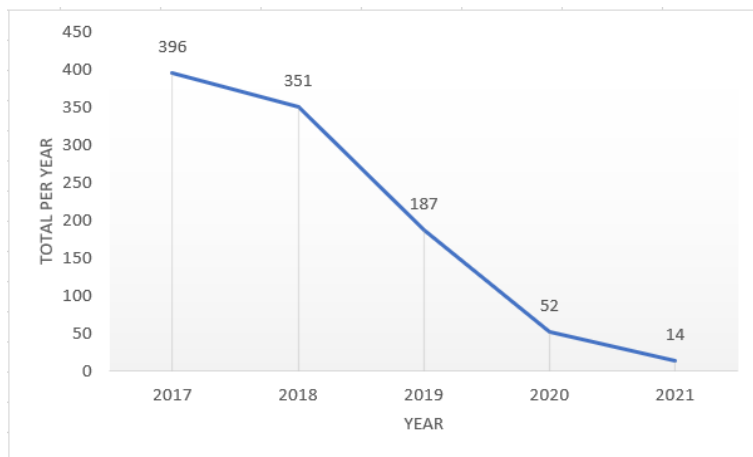


Fig. 1. Level of development in engineering research.

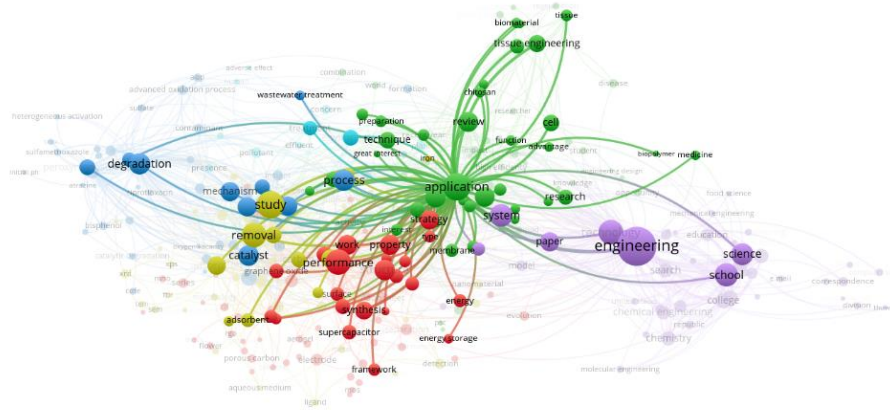


Fig. 4. Application term network visualization.

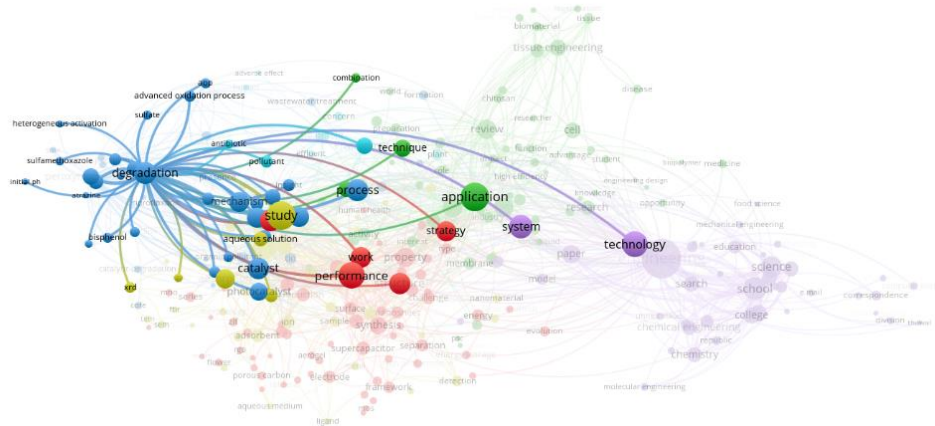


Fig. 5. Degradation term network visualization.

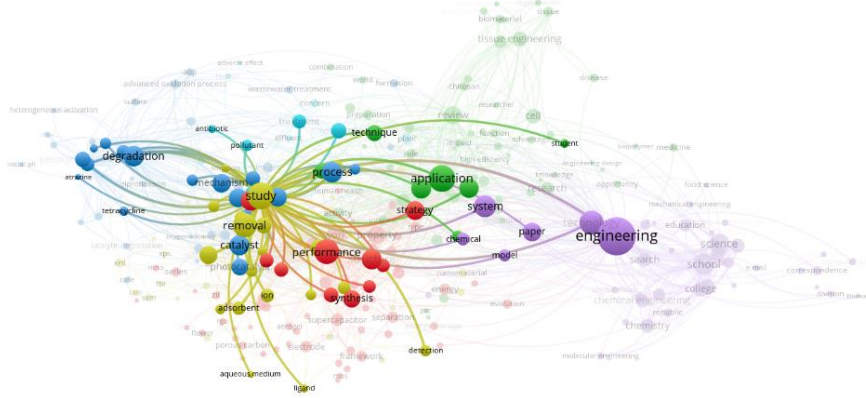


Fig. 6. Study term network visualization.

Figure 11 shows density visualization, which means that the darker or brighter the yellow colour and the larger the diameter of the circle of a term, the more frequently that term appears. This means that research on related terms is getting higher in number. If the colour of the term fades closer to the background colour, the number of studies on that term will decrease [42]. Based on Fig. 11, we can see that research related to application, engineering, study, removal, catalyst, and performance has a high number of studies.

Based on the results of the data mapping of articles that have been collected, it appears that the keywords that appear the most are performance, application, degradation, study, and engineering. From this data, we can look for research on new engineering. Like computer science, which is the most trending term, but there are still few people researching it. Can also research in the field of environmental engineering which is still a little scope of research terms that have been done.

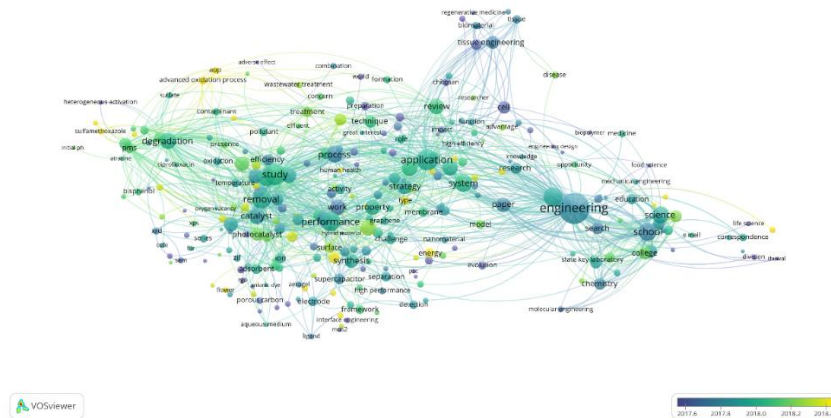


Fig. 9. Overlay Visualization of engineering keywords.

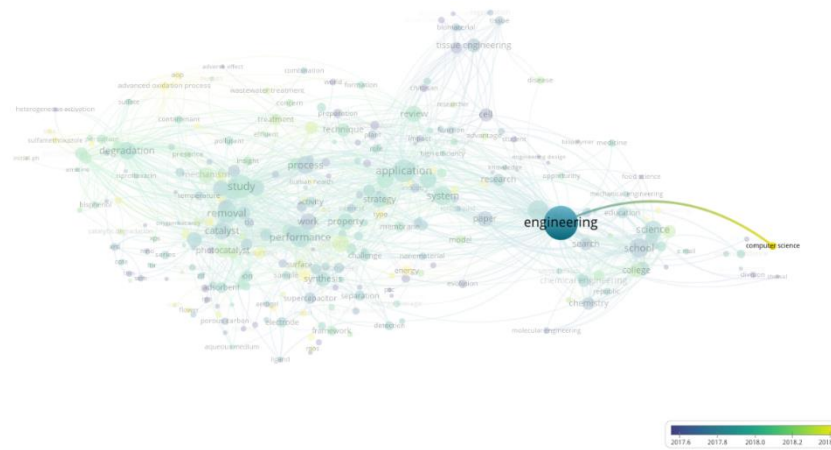


Fig. 10. Overlay visualization link of the term with research in engineering.

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