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Research Mapping in the Use of Technology for Fake News Detection: Bibliometric Analysis from 2011 to 2021

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ABSTRACT

This study aims to (1) determine research developments, (2) produce research distribution maps based on co-authorship analysis, (3) produce research distribution maps based on citation analysis, (4) produce research distribution maps based on co-citation analysis, (5) produce a research distribution map based on co-occurrence analysis, and (6) find out the state-of-the-art research in the use of technology for fake news detection. This study uses a quantitative method with a descriptive approach in bibliometric analysis from 2011 to 2021. From the research results obtained (1) the development of research publications in the field of the use of technology for fake news detection shows an increase, (2) the interrelationships between countries of authors, organizations affiliated with the authors, and among authors, (3) distribution map of citation analysis based on units of countries, sources, and authors, (4) distribution map of co-citation analysis based on unit cited sources and cited authors, (5) connection of keyword in the use of technology for fake news detection publications is related to literacy skills such as media literacy and information literacy, and (6) several research trends that researchers have widely used in the last 2 years including COVID-19, media literacy, and cyber deception. The research results can be used to determine the development of research o in the use of technology for fake news detection and as a reference for developing further research in the use of technology for fake news detection.

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1. INTRODUCTION

The increasing adoption of digital technology worldwide has been accompanied by an increase in the spread of fake news (Lim & Tan, 2020). The spread of fake news occurs along with the widespread use of social media (Carter, 2019), such as Facebook, WhatsApp, Twitter, and Instagram (S. Sharma & Sharma, 2019). The Ethical Journalism Network (EJN) defines fake news as information that is intentionally created and published with the intent to deceive and mislead others into believing lies or doubting verifiable facts (De Vicente Domínguez *et al*., 2021). Fake news presents a different kind of content where conspiracy theories are a recurring topic with frequent and harmful implications (Scheibenzuber *et al*., 2021). These fake news items imitate real news and are intended to spread virally for the benefit of changing individual beliefs (Voinea *et al*., 2020). Even the spread of fake news is happening in the world of education which faces at least two big challenges in 2020 besides emergency and infodemic online learning (Scheibenzuber *et al*., 2021).

One of the main factors that influence beliefs in online disinformation and misinformation is low education or digital literacy (Baptista & Gradim, 2020). Prevention of misinformation among citizens can be prevented through digital literacy to build critical thinking. This digital literacy can help individuals to recognize and manage the risks faced in cyberspace (Rodrigo *et al*., 2022). Therefore, effective detection to identify fake news is important because of its negative impact on individuals and society (Zhang & Ghorbani, 2020). It is very important to detect fake news as soon as possible to prevent its spread (Alonso *et al*., 2021). In simple terms, the detection of fake news is the task of assessing the truth of a particular piece of news (Zhang & Ghorbani, 2020). While Alonso *et al*. define fake news detection as the process of estimating whether a particular news article on any topic from any domain intentionally or unintentionally deviates (Alonso *et al*., 2021).

There have been several attempts by the industry as well as the scientific community to address the detection and verification of social media rumors, ranging from ongoing research projects to fully-fledged applications (Zubiaga *et al*., 2018). The development of effective tools to combat the phenomenon of fake news using machine learning (ML) methods is a significant challenge (Choraś *et al*., 2021). The purpose of an automated fake news detection system is to reduce human time and effort in detecting fake news (Alonso *et al*., 2021). A study written by Saleh *et al*. proposed a convolutional neural network (CNN) model optimized for detecting fake news (Saleh *et al*., 2021). Ni *et al*. developed a novel neural network model to detect fake news and provide explanations on social media (Ni *et al*., 2021). In addition, Umer *et al*. developed a hybrid neural network architecture that combines the capabilities of CNN and long short-term memory (LSTM) for an automated fake news detection tool (Umer *et al*., 2020). Verma, *et al*. proposed a two-phase benchmark model based on word embedding (WE) on linguistic features for fake news detection using machine learning classification (Verma *et al*., 2021).

There are research advances and methods used in research in the use of technology for the detection of fake news. One of the studies in using technology for fake news detection is to evaluate the performance of five machine learning models and three deep learning models on two real and fake news data sets (Jiang *et al*., 2021). Another similar study evaluated the performance of two machine learning models and three deep learning models using two different English news datasets (Alameri & Mohd, 2021). In addition, some studies discuss ways to detect deviant content that can be followed by the general public (Sharma *et al*., 2021). The research was written by Sharma *et al*. it also provides detailed information about the

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tools and extensions that are already available for fake news detection where the public can access these tools to determine the content that is predicted to be fake. This can help the general public to know the basic techniques of identifying fake news. In addition, another study analyzed the current state of knowledge in detecting fake news to suggest solutions and identify key challenges and methodological gaps to motivate future research (Choraś *et al*., 2021).

Based on the explanation of the research and the methods used in the research in the use of technology for the detection of fake news, however, there has been no research on mapping research in the use of technology for the detection of fake news using bibliometric analysis. This study aims to determine the development of research, research distribution maps, and state-of-the-art research in the use of technology to detect fake news using quantitative methods with a descriptive approach in bibliometric analysis. Based on the background of the research that has been submitted, the problems studied can be formulated in the following questions:

(i) How is the development of research in the use of technology to detect fake news in the 2011-2021 range based on the Scopus database?
(ii) How is the distribution map of research in the use of technology for fake news detection based on co-authorship analysis in the 2011-2021 range based on the Scopus database?
(iii) How is the distribution map of research in the use of technology for the detection of fake news based on citation analysis in the 2011-2021 range based on the Scopus database?
(iv) How is the distribution map of research in the use of technology for the detection of fake news based on co-citation analysis in the 2011-2021 range based on the Scopus database?
(v) How is the distribution map of research in the use of technology for the detection of fake news based on co-occurrence analysis in the 2011-2021 range based on the Scopus database?
(vi) What is the state-of-the-art research in the use of technology to detect fake news?

The limitation of the problem in this study is the data used in the form of English-language journal articles with publication limitations in the range of 2011 to 2021, the data used comes from the Scopus database. The data used is based on search keywords in the use of technology to detect fake news. This study uses VOSviewer software to map the results of the development of publications. VOSviewer was selected since this software has been well-developed and well-documented in many areas (Al Husaeni & Nandiyanto, 2022; Al Husaeni & Nandiyanto, 2023; Al Husaeni *et al*., 2023; Bilad, 2022; Fauziah & Nandiyanto, 2022; Hamidah *et al*., 2020; Hirawan *et al*., 2022; Kurniati *et al*., 2022; Luckyardi *et al*., 2022; Mudzakir *et al*., 2022; Mulyawati & Ramadhan, 2021; Nandiyanto *et al*., 2022; Nandiyanto *et al*., 2020; Nandiyanto *et al*., 2023; Nandiyanto & 2021; Nandiyanto & Al Husaeni, 2022; Nordin, 2022; Nugraha & Nandiyanto, 2022; Ragahita & Nandiyanto, 2022; Riandi *et al*., 2022; Saputra *et al*., 2022; Setiyo *et al*., 2021; Shidiq *et al*., 2021; Shidiq, 2023; Soegoto *et al*., 2022; Sudarjat, 2023; Wiendartun *et al*., 2022; Wirzal & Putra, 2022).

2. METHOD

This study uses a quantitative method with a descriptive approach in bibliometric analysis. Bibliometric studies summarize the application of quantitative methods such as the analysis of bibliometric data, namely the publication unit (Donthu *et al*., 2021). The use of bibliometric analysis in this study aims to find out global research development, a map of the distribution of research, as well as the state-of-the-art in the use of technology to detect fake news.

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2.1. Data Collection

The data source in this study is research publications based on keywords in the Scopus database, namely English-language journal articles with publication limitations in the range of 2011 to 2021. Then, from this data source, the metadata of articles is taken in comma-separated value (CSV) format, namely the author, title, year, source, affiliation, abstract, reference, publisher, abstract, keywords, and so on. The data collection process is presented in the flow chart shown in **Figure 1**. Data mining was carried out on March 14, 2022, from the Scopus database by entering the following keywords.

(TITLE-ABS-KEY ("fake news" OR "hoax news" OR misinformation OR disinformation OR "inaccurate news" OR "media manipulation" OR deception OR propaganda) AND TITLE-ABS-KEY (detection OR observation OR perception OR recognition OR identification OR noticing OR noting OR discernment OR spotting OR awareness OR distinguishing) AND TITLE-ABS-KEY (technolog*)) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011)) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")).

The data obtained are 272 documents which are English journal articles with publication limitations in the range of 2011 to 2021 as shown in **Figure 2**. The data obtained are then sorted to filter out the same or similar keywords using the thesaurus feature in the OpenRefine web-based application. The results of data processing from OpenRefine are then entered into the VOSviewer software to view the results of the visualization of the mapping of co-authorship, citation, co-citation, and co-occurrence research. The visualized results are a collection of keywords, authors, institutions affiliated with the author, the author's country of origin, and article citations. The visualization that has been successfully generated by VOSviewer is then analyzed using the bibliometric method to see the development of research in the use of technology to detect fake news.

2.2. Data Analysis

This type of bibliometric analysis is divided into several types, namely co-authorship, citation, co-citation, and co-occurrence analysis with the data used from the Scopus database. The data analysis techniques used for bibliometric analysis in this study are as follows:

(i) Co-authorship analysis reveals patterns of authorship and connectivity among collaborating authors (Donthu *et al.*, 2020).

(ii) Citation analysis is a basic science mapping technique that operates on the assumption that citations reflect intellectual linkages between publications that are formed when one publication cites another (Donthu *et al.*, 2021).

(iii) Co-citation analysis is defined as the frequency with which two documents are quoted simultaneously. The greater the frequency, the stronger their relationship (Liu *et al.*, 2015).

(iv) Co-occurrence analysis describes the conceptual structure or knowledge of the literature (Donthu *et al.*, 2020). Analysis based on these keywords to see visualized data developments and research trends.

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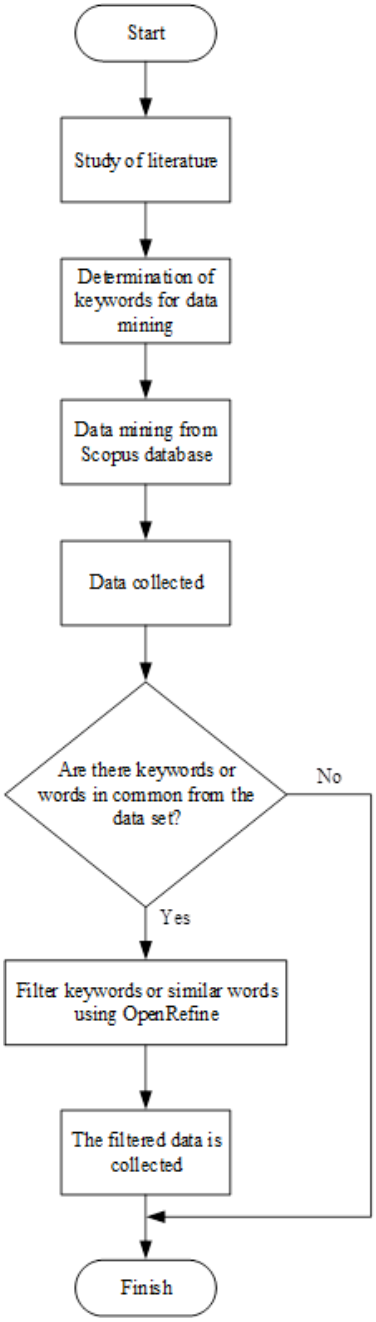

Figure 1. Data collection process flowchart**.**

Figure 2. Data mining results.

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3. RESULTS AND DISCUSSIONS

In this section, the author will discuss the results of 272 datasets taken from the Scopus database. The results provide aspects based on the research questions formulated as follows:

3.1. Development of Research Publications in The Use of Technology for Fake News Detection

The development of research publications in the use of technology for the detection of fake news from 2011 to 2021 is shown in **Figure 3**. Analysis of the data set by year of publication allows us to describe the evolution of articles available in the Scopus database on research in the use of technology for the detection of fake news (Maseda *et al*., 2021). The development of research publications in the use of technology for the detection of fake news shows an increase, the data presents 272 documents from 2011 to 2021. In the first 7 years, the average publication produced reached 11 documents, with the highest number of articles in 2015 which was 17 documents, and the lowest number of articles in 2013 was 6 documents. In 2011 the number of articles published was 9 documents at which time the phenomenon of the influence of fake news and rumors on public opinion had started to become relevant (Bondielli & Marcelloni, 2019). In the case of fake news, there was little publicity before 2016, but the rapid growth that started in 2017 has led to fake news becoming the most important subject of research on this issue since 2018, surpassing rumors (Alonso *et al*., 2021).

From 2018 to 2021, there will be an increase in research publications in the field of the use of technology to detect fake news, with the highest number of articles in 2021, namely 84 documents. This indicates that research in the area of the use of technology for fake news detection continues to grow rapidly even though the area of interest in this area is relatively new. Many researchers are trying to find techniques to classify fake news from real news and it has been noted an increasing number of researchers in this field (Vishwakarma & Jain, 2020). The article related to the study topic that has the highest number of citations is 'A Survey on Security Control and Attack Detection for Industrial Cyber-physical Systems' written by (Ding *et al*., 2018). When the COVID-19 pandemic in early 2020 hit the whole world today, it has been accompanied by the spread of fake news and misinformation on social media. Even the spread of fake news is happening in the world of education which faces at least two big challenges in 2020 besides emergency and infodemic online learning (Scheibenzuber *et al*., 2021).

Figure 3. Development of research publications in the use of fake news detection technology from 2011 to 2021.

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3.2. Distribution Map of Research in The Use of Technology for Fake News Detection Based on Co-Authorship Analysis

3.2.1. Co-Authorship analysis distribution map based on unit countries

Co-authorship analysis was used to assess trends in collaboration among influential countries, where opportunities for discovering new information and knowledge through collaboration could be identified (Nobanee *et al*., 2021). This analysis is carried out with a minimum of one document per country. The number of documents, citations, and collaboration interconnections in the co-authorship analysis by country is shown in **Figure 4**.

In **Figure 4**, the top 10 countries are taken based on the number of documents produced. The United States is the country with the first rank based on the number of documents that examine studies in the use of technology for the detection of fake news with a total of 71 documents. China (30), UK (27), Canada (21), and India (16) are next in rank. Meanwhile, the ranking of countries based on the number of citations in the first order is the same as countries based on the number of documents, namely the United States with 1062 citations.

The number of citations displayed is the number of citations on all documents published by a country, where the number of citations in each document is not evenly distributed. The next ranking is followed by Canada (744), Australia (570), England (476), and Italy (243). Based on these data, the United States is the most productive country that not only excels in document publication but excels in obtaining citations. China is the second-ranked country based on the number of documents, which is 30, but China has many citations below the UK and Canada, which is only 165 citations. Therefore, the large number of publications in a country does not affect those publications to be cited by other researchers. Meanwhile, Australia is a country that ranks sixth based on the number of documents but has a fairly high number of citations compared to countries ranked above it in the number of documents, namely 570 citations.

The document network visualization map in the co-authorship analysis by country is shown in **Figure 5**. There are 88 links and 106 collaboration interconnections displayed on the visualization map. Collaborative interconnection in this co-authorship analysis explains collaboration or relations between countries in producing a document. There are 41 countries divided into 8 clusters.

According to the data in **Figure 4**, the document network visualization map in the co-authorship analysis based on these countries shows that the United States accounts for the majority of publications regarding the use of technology for fake news detection, which is characterized by the largest node size. The United States is the country with the first rank based on the number of inter-collaboration powers with 23 collaborative interconnections. The next ranking is followed by England (20), Canada (17), Australia (14), and Italy (13).

This shows that the United States is a country that has high collaboration between countries in producing publications on studies in the use of technology for the detection of fake news. The country that published the article in 2011 was Cyprus. Furthermore, several countries that published articles during the 2015-2017 period included Kenya, the Netherlands, and the United States. While Portugal and Cuba are examples of countries that publish articles in 2020 and 2021.

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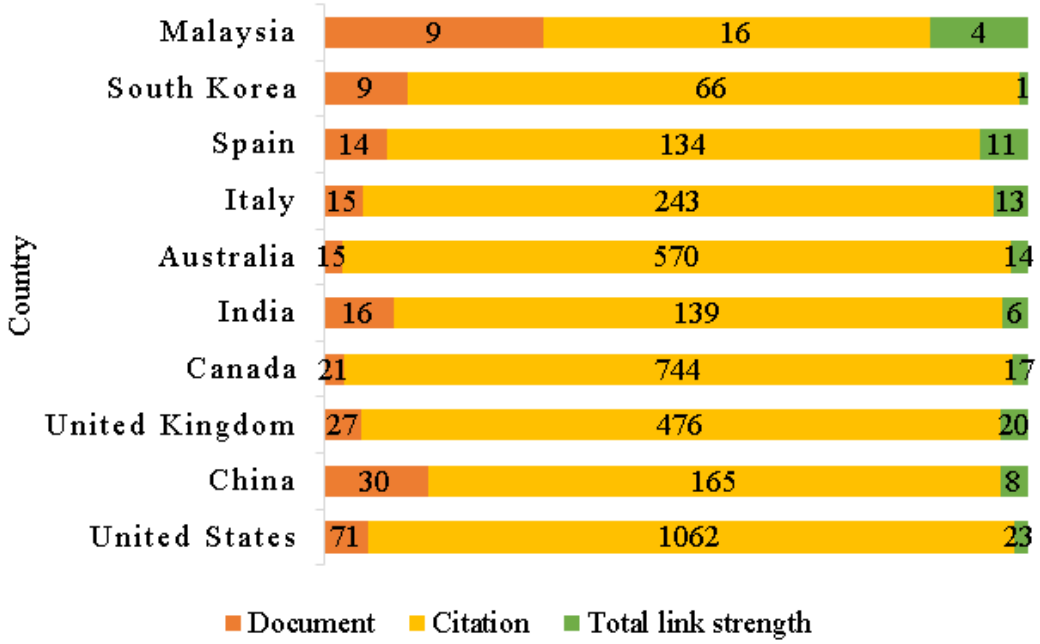

Figure 4. Number of documents, quotations, and collaboration interconnections in co-authorship analysis by countries.

Figure 5. Document network visualization map on co-authorship analysis based on countries.

3.2.2. Co-Authorship analysis distribution map based on unit organizations

The co-authorship analysis based on unit organizations is carried out with a minimum of two documents per organization. The number of documents and citations in the co-authorship analysis by the organization is shown in **Figure 6**. There are 8 organizations that research studies the use of technology for fake news detection with 2 documents each. The Language and Information Technology Research Lab (LiT.RL), Faculty of Information and Media Studies, University of Western Ontario, London, Canada is the first organization ranked by several citations researching studies in the use of technology for fake news detection with 453 citations. The next ranking was followed by the School of Electrical Engineering, University of Ulsan, Ulsan, South Korea with 56 citations. The article related to the study topic that has the highest number of citations is 'Automatic Deception Detection: Methods for Finding Fake News' written by Conroy *et al*. This article, which was researched by the Language and Information Technology Research Lab (LiT.RL) and cited 396 times, surveys technologies that play an important role in the adoption and development of fake news detection.

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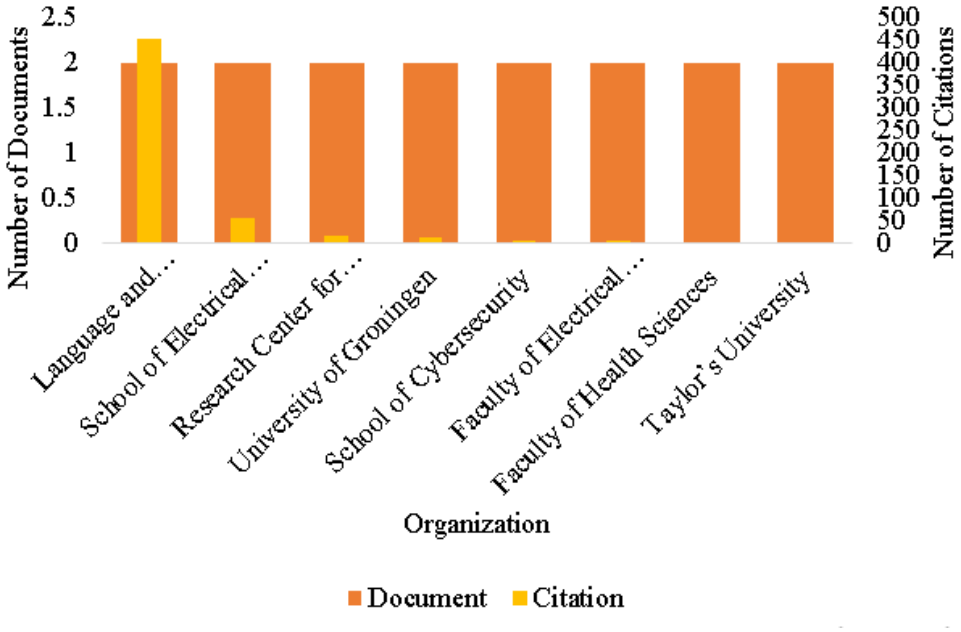

Figure 6. Number of documents and quotations on co-authorship analysis by organizations.

The document network visualization map in the co-authorship analysis by the organization is shown in **Figure 7**. 8 organizations are not connected and are divided into each cluster with a different color. According to the data in **Figure 6**, this visualization map shows that all organizations have the same number of documents and are represented by the same node size. The University of Groningen is an organization that published an article in 2013 showing that it published articles on the use of technology for the detection of fake news earlier than others. Furthermore, the Language and Information Technology Research Lab (LiT.RL), Faculty of Information and Media Studies, University of Western Ontario is an organization that published articles in 2015. Meanwhile, the School of Electrical Engineering, University of Ulsan, and Taylor's University, Subang Jaya is an organization that publishes articles in 2018 and 2019. Meanwhile, the Faculty of Electrical Engineering and Informatics, Technical University of Kosice is an organization that publishes articles in 2021.

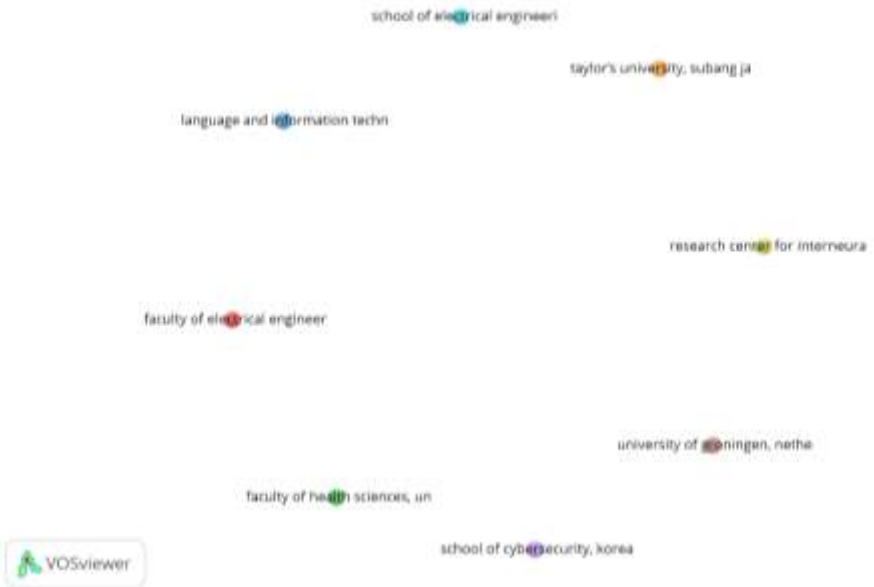

Figure 7. Document network visualization map on co-authorship analysis by organizations.

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3.2.3. Co-Authorship Analysis Distribution Map Based on Unit Authors

VOSviewer software was used to perform co-authorship analyses to identify key organizations and scientists, as well as examine author associations (Nobanee *et al.*, 2021). This analysis was performed with a minimum of two documents per author. The number of documents, citations, and collaboration interconnections in the co-authorship analysis by authors is shown in **Figure 8**. Rubin, V. L. is the first author ranked by several documents examining studies in the use of technology for fake news detection with a total of 6 documents. The next ranking is followed by Chen, Y. and Lee, Y with 3 documents each. Meanwhile, the author's ranking based on the number of citations in the first order is the same as the author based on the number of documents, namely Rubin, V. L. with a total of 503 citations. The next ranking is followed by Chen, Y. with 457 citations and Conroy, N. J. with 453 citations. Based on these data, Rubin, V. L. is the most prolific writer who not only excels in document publication but excels in obtaining citations. In addition, the number of published documents from Rubin, V. L. which only published 6 documents did not affect the publication to be widely cited by other researchers until it reached 503 citations.

The document network visualization map in the co-authorship analysis by the authors is shown in **Figure 9**. There are 21 links and 32 collaboration interconnections displayed on the visualization map. 32 of the 39 authors are not connected so only 7 authors divided into 2 clusters can be displayed. Choi, J. is the author with the first rank based on the number of inter collaboration strengths with a total of 10 collaboration interconnects. Other writers such as Kim, T., Lee, G., Lee, J., and Shim, S. W. also have a total of 10 collaborative interconnects. Based on these data, although these five authors have a small number of document publications and citations, they have strong collaboration interconnections so that they can be displayed on a visualization map. While the other two writers, namely Lee, H. and Kim, Y. each have 7 collaboration interconnections. There are 2 clusters represented by two different colors on the visualization map. Cluster 1 is represented by red color and consists of 5 authors, including Choi, J., Kim, T., Lee, G., Lee, J., and Shim, S. W. While cluster 2 is represented by green color which consists of 2 authors., namely Lee, H and Kim, Y. These nodes are connected by lines that indicate co-writing within groups and between groups. Lee, H. and Kim, Y. are authors who published articles in 2018. While other authors published articles in 2020.

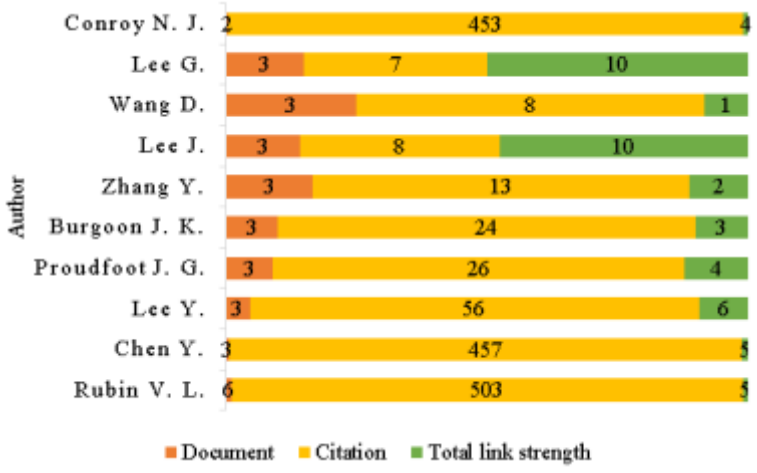

Figure 8. Number of documents, quotations, and collaborative interconnections in co-authorship analysis by authors.

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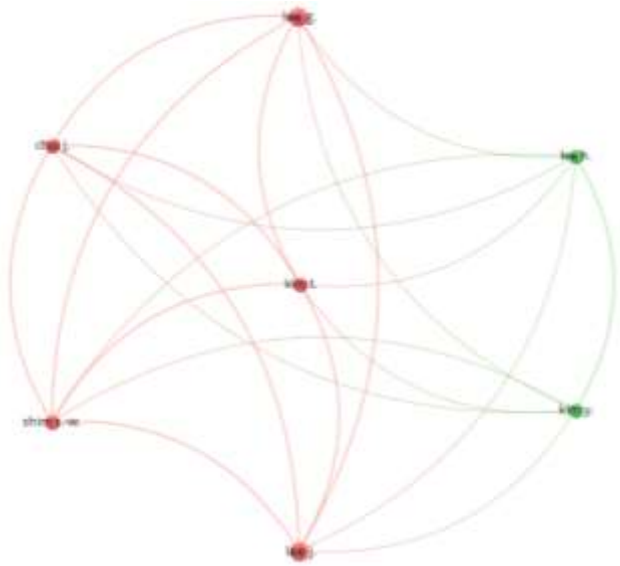

Figure 9. Document network visualization map on co-authorship analysis based on authors.

3.3. Distribution Map of Research in The Use of Technology for Fake News Detection Based on Citation Analysis

3.3.1. Citation analysis distribution map based on unit countries

Citation analysis is a basic science mapping technique that operates on the assumption that citations reflect intellectual linkages between publications that form when one publication cites another (Donthu *et al.*, 2021). This analysis is carried out with a minimum of one document per country. The countries with the highest number of cited publications in the citation analysis by country are shown in **Figure 10**. The United States is the first country based on the number of cited publications that examine studies in the use of technology for fake news detection with a total of 1062 citations. The next ranking based on the number of publications cited is followed by Canada (744), Australia (570), the United Kingdom (476), and Italy (243).

Figure 10. Countries with the top number of cited publications in citation analysis by countries.

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The network visualization map in the citation analysis by country is shown in **Figure 11**. There are 22 links and 27 collaborative interconnections displayed on the visualization map. The collaborative interconnection in this citation explains the inter-relationship of citing between countries. There are 17 countries displayed on the visualization map which are divided into 7 clusters.

According to the data in **Figure 10**, this visualization map shows the United States accounted for the most publications regarding the use of technology for fake news detection based on the number of publications cited. The United States of America is a country located in cluster 3 which is blue with Belgium and France. Although the United States accounts for the majority of publications in the use of technology for fake news detection based on the number of publications cited, the United States has only 5 collaborative interconnections. The country with the first rank based on the number of inter collaboration strengths is Canada with 16 collaborative interconnections. Australia (6), the United States (5), India (4), and Taiwan (4) rank next. This shows that the United States is not a country that has high collaboration between countries in citing publications on studies in the use of technology for fake news detection. Canada, which has the highest number of inter-collaboration powers, is a country located in cluster 1 which is red with Malaysia, Mexico, and Russia.

3.3.2. Citation analysis distribution map based on unit sources

One of the basic assumptions of citation analysis is being able to reveal the influence of a particular article with the citations it receives in other articles (Rossetto *et al.*, 2018). This analysis is carried out with a minimum of two documents per source. The source with the highest number of cited publications in the citation analysis by sources is shown in **Figure 12**. Proceedings of The Association for Information Science and Technology is the first ranked source based on the number of cited publications that examine studies in the use of technology for fake news detection with a total of 473 citations. The next rank was followed by Neurocomputing (425) and Information Processing and Management (157).

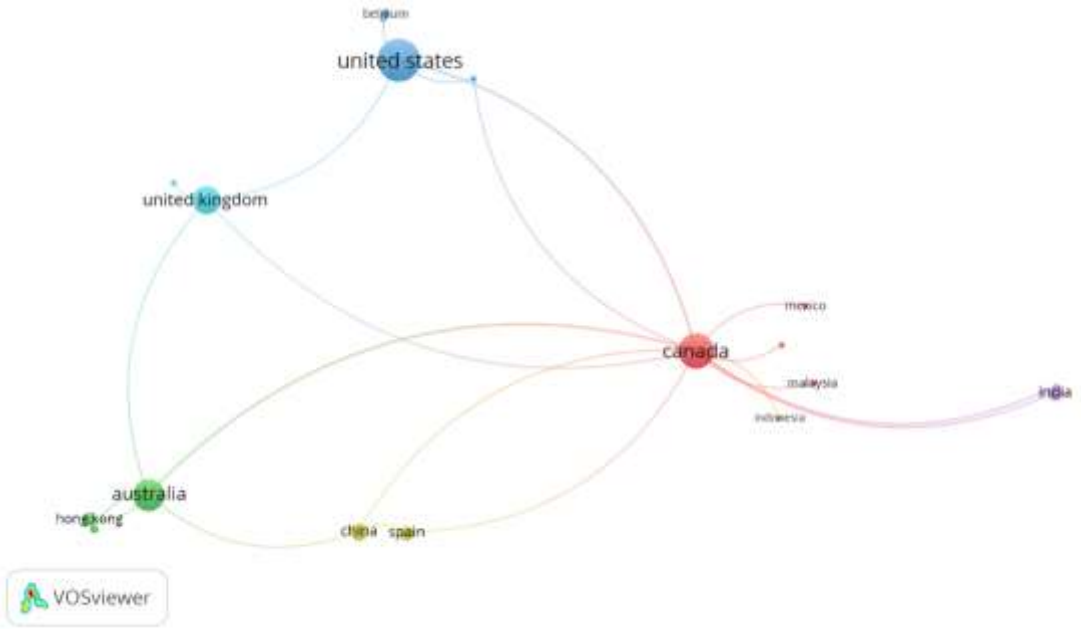

Figure 11. Map of network visualization on citation analysis by countries.

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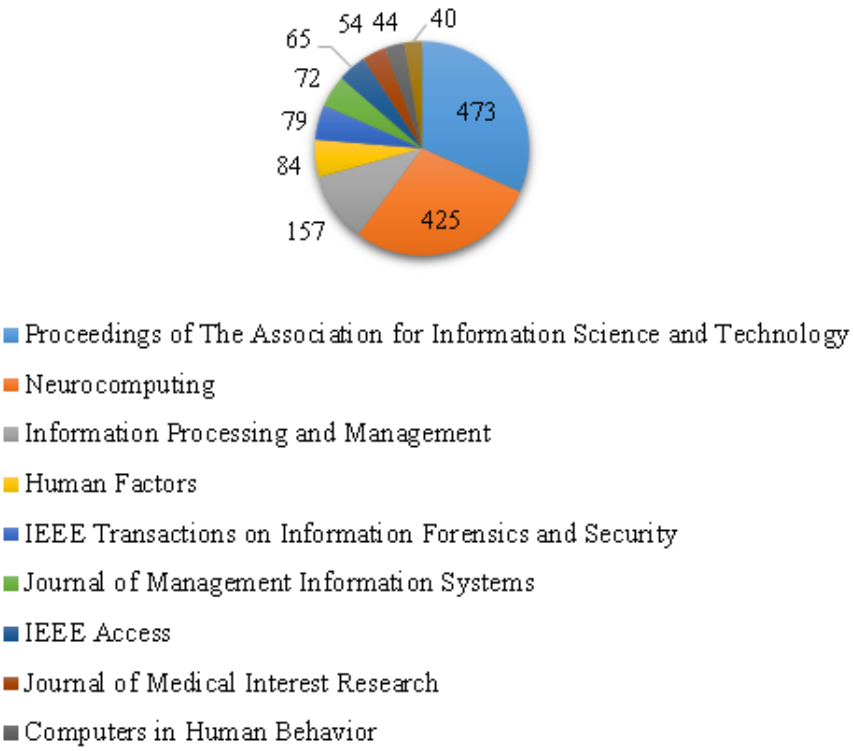

Figure 12. Sources with top number of publications cited in citation analysis by sources.

The network visualization map in citation analysis based on sources is shown in **Figure 13**. Of the 30 sources, 24 sources are not connected so only 4 connected sources can be displayed. There are 3 links and 4 resources which are divided into 2 clusters which are represented by two different colors. The Journal of Documentation and Proceedings of The Association for Information Science and Technology are sourced with a total of 2 strengths of collaboration. Meanwhile, First Monday and Information Processing and Management each have 1 collaboration interconnect. Based on these data, the Journal of Documentation and Proceedings of The Association for Information Science and Technology have interconnections that are connected by lines even though they are in different clusters which are shown on the visualization map. Cluster 1 is represented by red color which consists of Proceedings of The Association for Information Science and Technology and Information Processing and Management. Meanwhile, cluster 2 is represented by green color consisting of First Monday and Journal of Documentation. First Monday is a source that publishes articles in 2014. Furthermore, sources that published articles during the 2016-2017 period are the Journal of Documentation and Proceedings of The Association for Information Science and Technology. Meanwhile, Information Processing and Management is a source that publishes articles in 2020.

Figure 13. Network visualization map on citation analysis based on sources.

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3.3.3. Citation analysis distribution map based on unit authors

Using citation analysis, you can find the most influential publications in the research area to gain an understanding of the intellectual dynamics of the field (Donthu *et al*., 2021). This analysis was conducted with a minimum of two documents per author. The authors with the highest number of cited publications in the citation analysis by authors are shown in **Figure 14**. Rubin, V. L. is the first-ranked author by several publications cited with a total of 503 citations. The next ranking is followed by Chen, Y. (457) and Conroy, N. J. (453).

The network visualization map in the citation analysis by the authors is shown in **Figure 15**. There are 20 links and 30 collaborative interconnections displayed on the visualization map. There are 7 authors divided into 2 clusters that can be displayed. Choi, J. is the author with the first rank based on the number of inter collaboration strengths with a total of 10 collaboration interconnects. Other writers such as Kim, T., Lee, G., Lee, J, and Shim, S. W. also have a total of 10 collaborative interconnects. Meanwhile, Lee, H. and Kim, Y. each have 5 collaboration interconnects. Based on these data, the authors shown on the visualization map are authors who have strong collaboration interconnections even though they do not have a large number of cited publications. There are 2 clusters represented by two different colors on the visualization map. Cluster 1 is represented by red color which consists of 6 authors, including Choi, J., Kim, T., Kim, Y., Lee, G., Lee, J., and Shim, S. W. While cluster 2 is represented by green color. consisting of 1 author, namely Lee, H.

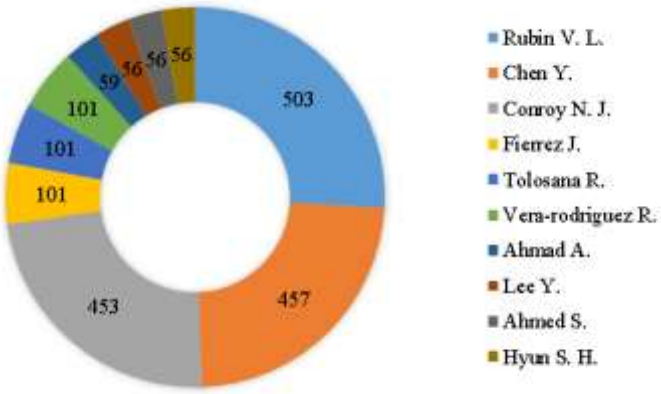

Figure 14. Authors with the top number of cited publications in citation analysis by authors.

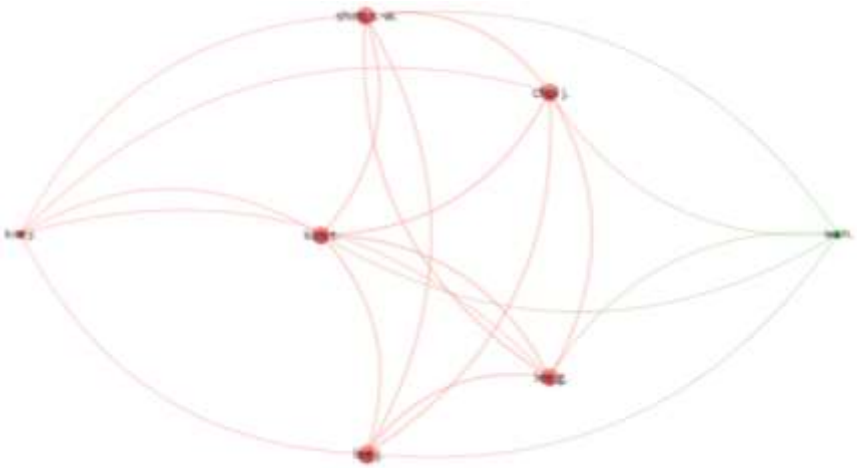

Figure 15. Network visualization map on citation analysis based on authors.

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3.4. Distribution Map of Research in The Use of Technology for Fake News Detection Based on Co-Citation Analysis

3.4.1. Co-Citation analysis distribution map based on unit-cited sources

Co-citation is defined as the frequency with which two documents are quoted simultaneously. The greater the frequency, the stronger their relationship (Liu *et al*., 2015). Co-citation analysis is a widely used bibliometric method that supports empirical investigations of academic structures and activities of various disciplines (Rossetto *et al*., 2018). The analysis was carried out with a minimum of 13 citations, the journal sources collected were 55. The sources with the highest cited publications in the co-citation analysis based on cited sources are shown in **Table 1**. Journal of Management Information Systems is the first-ranked source based on the number of publications cited. who examined a study on the use of technology for fake news detection with 57 citations. The next ranking was followed by Computers in Human Behavior (54) and Plos One (54). Journal of Management Information Systems is also the source with the first rank based on the number of collaboration interconnections, namely 1364 collaboration interconnections. The next ranking was followed by Mis Quarterly (1302) and the Journal of Applied Psychology (1100).

The network visualization map in the co-citation analysis based on cited sources is shown in **Figure 16**. Of the 55 sources in the network, one source is not connected so only 54 sources can be displayed. There are 484 links, 10519 collaborative interconnections, and 7 clusters displayed. The sources with the largest cited publications in each of these clusters include Journal of Management Information Systems (red – 13 items), Plos One (green – 11 items), Journalism Studies (blue – 9 items), and IEEE Trans. Smart Grid (yellow color – 7 items), IEEE Access (purple color – 6 items), Computers in Human Behavior (Tosca color – 5 items), and Journal of Applied Psychology (orange – 3 items).

Table 1. Sources with top cited publications on co-citation analysis based on cited sources.

No.	Source	Citations	Total Link Strength
1.	Journal of Management Information Systems	57	1364
2.	Computers in Human Behavior	54	800
3.	Plos One	54	278
4.	Mis Quarterly	52	1302
5.	Science	44	329
6.	Law and Human Behavior	40	959
7.	IEEE Access	39	470
8.	Journal of Applied Psychology	38	1100
9.	Journal of Personality and Social Psychology	35	656
10.	Psychophysiology	35	945

Figure 16. Network visualization map on co-citation analysis based on citation sources.

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3.4.2. Co-Citation analysis distribution map based on unit cited authors

The co-citation analysis cited by the authors focuses on the interrelationships between the authors within the research field (Liu *et al.*, 2015). Measuring the frequency of co-occurrence of individual works by different authors in a bibliography can identify interconnections between authors. The analysis was carried out with a minimum of 18 citations, resulting in a total of 55 journal authors. The authors with the highest cited publications in the co-citation analysis based on cited authors are shown in **Table 2**. Burgoon, J. K. is the first-ranked author by several publications cited that examined the study in the use of technology for fake news detection with 110 citations. The next ranking is followed by Chen, Y. (60 citations) and Rubin, V. L. (57 citations). Burgoon, J. K. is also the author with the first rank based on the number of collaboration interconnects, which is 3002 collaboration interconnects. The next ranking was followed by Nunamaker, J. F. (1819 links) and Bandyopadhay, A. K. (1517 links).

The network visualization map in the co-citation analysis based on the authors cited is shown in **Figure 17**. Of the 55 authors in the network, 2 sources are not connected so only 53 connected sources can be displayed. There are 723 links, 19217 collaborative interconnects, and 3 clusters displayed. Authors with the largest cited publications in each of these clusters include Chen, Y. (red – 23 items), Burgoon, J. K. (green – 19 items), and Wang, Z. (blue – 11 items).

Table 2. Authors with top cited publications on co-citation analysis based on cited authors.

No.	Author	Citations	Total Link Strength
1.	Burgoon J. K.	110	3002
2.	Chen Y.	60	1023
3.	Rubin V. L.	57	873
4.	Nunamaker J. F.	50	1819
5.	Vrij A.	48	999
6.	Depaulo B. M.	46	1320
7.	Liu Y.	46	1019
8.	Liu H.	42	959
9.	Bandyopadhay A. K.	41	1517
10.	Ekman P.	41	697

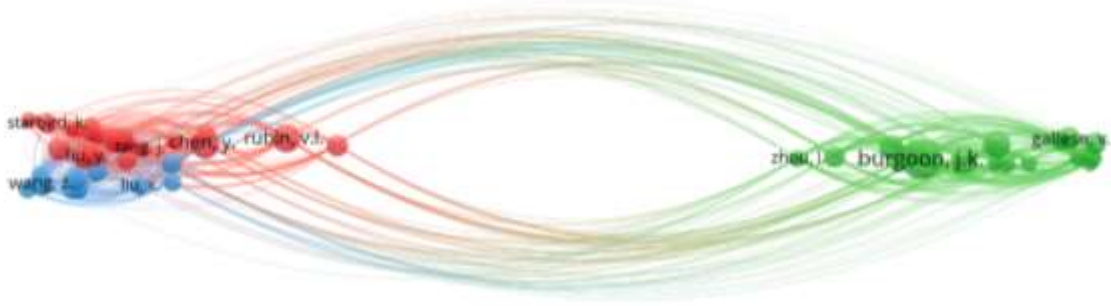

Figure 17. Map of network visualization in co-citation analysis based on cited authors.

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3.5. Distribution Map of Research in The Use of Technology for Fake News Detection Based on Co-Occurrence Analysis

3.5.1. Clustering and year distribution of keyword research in the use of technology for fake news detection

Co-occurrence analysis assumes that words that often appear together have a thematic relationship with each other (Donthu *et al*., 2021). In addition, the co-occurrence of author-defined keywords shows the spatial closeness between the various themes discussed (Donthu *et al*., 2020). This analysis describes the conceptual structure or knowledge of the literature based on keywords to see the development of the data used in the form of units or clusters. In the data set of 272 publications, a total of 1,062 keywords were used. Co-occurrence analysis was carried out with keywords that were repeated at least 2 times in the study. A total of 100 keywords meets these criteria and form fifteen different clusters. The list of top keyword occurrences based on co-occurrence analysis is shown in **Table 3**. “Fake news” is the most popular keyword used with 74 occurrences. Other keywords included in the top 10 rankings included “social media” (23), “fake news detection” (19), “artificial intelligence” (14), “machine learning” (13), “COVID-19” (12), “deepfake” (11), “internet” (8), “technology” (7), and “blockchain” (6).

The keyword network visualization map based on co-occurrence analysis is shown in **Figure 18**. There are 298 links, 405 collaborative interconnections, and 15 clusters displayed on the visualization map. The proximity of the nodes to each other and the thickness of the lines connecting them indicate the strength of co-occurrence between keyword pairs. A total of 7 clusters with the most items including studies on “cyber attacks” (red – 15 items), “internet” (green – 11 items), “COVID-19” (blue – 9 items), “credibility assessment” (yellow – 8 items), “media” (purple – 8 items), “social networks” (Tosca – 7 items), and “fake news” (orange – 7 items). The keyword "fake news" which has the strongest relationship is found in cluster 7 which is colored orange. In this cluster there are 7 items or other keywords besides “fake news” such as ethics, information security, lie detector, lies, memory, and polygraph. Cluster 1 in red has the most items regarding "cyber-attack" with 14 other keywords, namely anomaly detection, attack detection, cyber fraud, cyber security, cyber-physical systems, fraud attack, feature selection, genetic algorithms, internet/web technology, intrusion detection, network security, signal detection theory, smart grid, and state estimation.

5 clusters with other items having the most dominance of studies on the "internet" in cluster 2 which is green with 10 other keywords, namely communication, emotional intelligence, fraud, information technology, journalism, media literacy, privacy, public perception, technology, and terrorism. Cluster 3 is blue with the most items regarding "COVID-19" with 8 other keywords, namely big data, blockchain, digital media, health care, information literacy, information management, pandemic, and probit models. Cluster 4 is yellow with the most items regarding "credibility assessment" with 7 other keywords, namely framework, fraud, journalistic practice, natural language processing, news verification, online news, and SVM. Cluster 5 is purple with the most items regarding "media" with 7 other keywords, namely audience, Facebook, information, information verification, risk communication, social networking sites, and Twitter. Cluster 6 is colored tosca with the most items regarding "social networks" with 6 other keywords, accuracy, feature extraction, health communication, health information, interviews, as well as science and media.

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Table 3. Top keyword occurrence list based on co-occurrence analysis.

No.	Keyword	Occurrences	Total Link Strength
1.	fake news	74	111
2.	social media	23	45
3.	fake news detection	19	33
4.	artificial intelligence	14	23
5.	machine learning	13	28
6.	COVID-19	12	24
7.	deepfake	11	22
8.	Internet	8	22
9.	technology	7	11
10.	blockchain	6	14

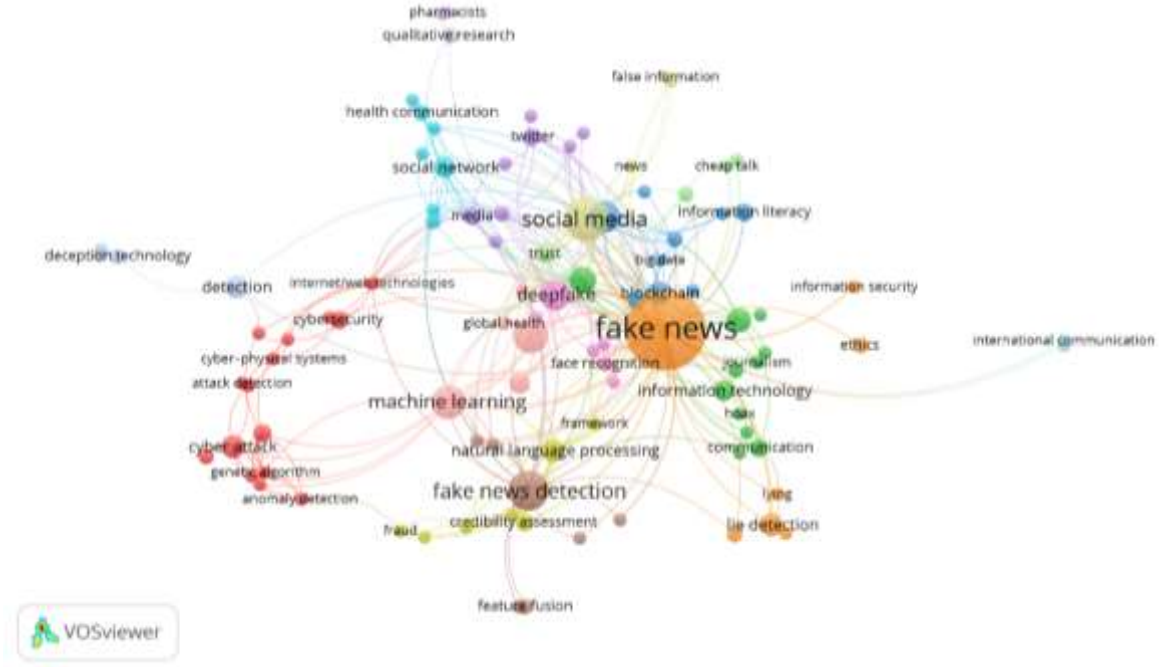

Figure 18. Keyword network visualization map based on co-occurrence analysis.

Popular keywords during the 2016-2018 period tended to fall into the groups associated with “credibility assessment” and “information technology” indicating that interest in these two areas emerged earlier than others. Second, the popular keywords during the 2018-2019 period were related to the correlation of “fake news”, “cyber attacks” and “machine learning”. "fake news" which is the most popular keyword used has an average year of publication in the middle of 2018 and 2019. While the keywords "cyber attack" and "machine learning" have an average year of publication in early 2019. Finally, “media digital” and “technology” describe the popularity or newer keywords that often appear in 2020. The keywords in this research topic will continue to appear as a combination of the latest topics as research developments continue to increase.

3.5.2. The relation of keyword media literacy and information literacy with research in the use of technology for fake news detection

The next analysis was carried out by looking at the relationship between keywords in fake news technology research publications related to literacy skills. The

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separation of these keywords was carried out to see that literacy skills were related to the detection of fake news. Detection of fake news is a particularly relevant issue due to the limitations of human literacy and cognitive and the inadequacy of machine-based approaches. To address this, it is necessary to combine social media news literacy educational tools and machine-based approaches to linguistic and network analysis (Okoro *et al*., 2018).

Educational interventions directed at fake news literacy aim to evaluate individual knowledge and skills, knowledge construction and reorganization, and transfer of knowledge and skills to enable adequate handling of online news (Scheibenzuber *et al*., 2021). The EU-HLGE recommends implementing a broad educational program on media and information to educate not only professional users of media platforms but also users of the public in general. A similar recommendation was made by SCAIPE Canada with a focus on awareness-raising campaigns and literacy programs for the whole community (Choraś *et al*., 2021).

One of the main factors that influence online misinformation trust is the low level of education or digital literacy (Baptista & Gradim, 2020). This fake news can be overcome by media literacy strategies (Carter, 2019) and information literacy (Scheibenzuber *et al*., 2021). In the era of fake news, information consumption patterns require media literacy to access, understand, analyze, evaluate, produce content, and differentiate between real and fake news (De Vicente Domínguez *et al*., 2021). The keyword "media literacy" is closely related to "fake news" which is the most popular keyword used. In addition, "media literacy" is also related to other keywords such as "technology" and "journalists" as shown in **Figure 19**.

The widespread use of media underscores the public, private, and family interactions that form the basis for youth ways of doing things involved throughout society, therefore the need for students to have media literacy skills is increasingly important (Deroo, 2021). In addition, resources for educators have grown in response to the increasing call for media literacy education in response to the existence of media and their influence on today's information and communication norms (Mihailidis *et al*., 2021).

Information literacy skills are used to disseminate and use information wisely as a cognitive skill (Ben Amram *et al*., 2021). The keyword "information literacy" is also closely related to "fake news" which is the most popular keyword used. The keyword "information literacy" is also related to other keywords such as "information management" as shown in **Figure 20**.

To disseminate and use information wisely, requires the ability to organize, find, and evaluate the information, as well as apply critical thinking. This ability is information literacy as a cognitive skill that must be developed along with technological skills to access and use information effectively (Ben Amram *et al*., 2021).

In the case of higher education, the need for students to have an adequate level of information literacy is even more pressing because their academic life takes place in a larger context of scientific information (Pinto *et al*., 2016). Information literacy is presented as a summary of the skills that every citizen must have to create a sustainable generation that interacts smoothly on digital networks and can manage the various information it presents (Gómez-García *et al*., 2020).

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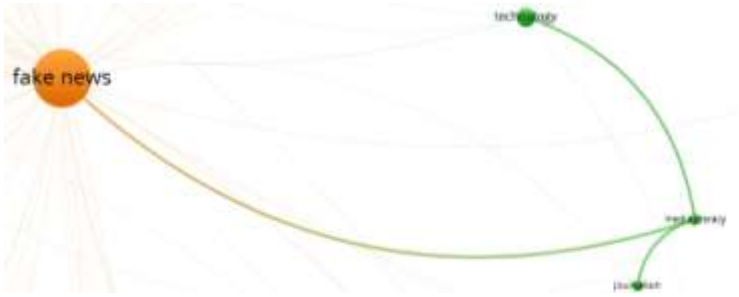

Figure 19. The relation of media literacy keywords with fake news.

Figure 20. The relation of information literacy keywords with fake news.

3.6. State-of-the-art Research in The Use of Technology for Fake News Detection

This study provides an overview of research in the use of technology for the detection of fake news through bibliometric analysis methods. This method is one method that shows a significant development in this research. Using co-occurrence analysis, state-of-the-art research was created in the use of technology to detect fake news. Network analysis using keywords is used to reveal the development and structure of the research field. This analysis helps in mapping the intellectual structure of the scientific literature (Nobanee *et al.*, 2021). This research on the use of technology to detect fake news shows several research trends that have been widely used by researchers in the last 2 years, including COVID-19, media literacy, and cyber deception.

COVID-19 is a popular research trend used in almost all published topics since 2020. COVID-19 is also closely related to research on the use of technology to detect fake news. The increasing use of social media and other virtual world platforms during this pandemic has coincided with the emergence of fake news about COVID-19. Therefore, many researchers have started to conduct research closely related to COVID-19. One study examined the opinion of demographic groups about COVID-19 vaccination to detect potential fears and reasons for negative attitudes towards vaccination and to eliminate possible misinformation that could influence vaccine doubt (Guljaš *et al.*, 2021). In addition to research using data collection in online questionnaire surveys, there are also studies that present studies on the dissemination of information on open networks about COVID-19 examples and are carried out using web scraping, linguistic analysis methods, and visual analysis (Ulizko *et al.*, 2021). Based on these studies, research trends regarding COVID-19 can continue to be used during this pandemic for

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research on mass opinion about the spread of fake news and technology that can be used to detect fake news.

Media literacy is a popular research trend used in research in the use of technology to detect fake news since 2021. As explained in the previous sub-chapter, literacy skills are related to detecting fake news. There is a study that aims to analyze the technology that is integrated into media literacy in universities using a qualitative approach. Media literacy activists need to encourage media literacy activities to passively refrain from spreading false news and actively spread media literacy awareness (Mukhtar & Putri, 2021). Improved media literacy can help reduce misperceptions caused by rampant misinformation (Xiao *et al*., 2021). Research trends regarding media literacy can continue to be used for research on the relationship between literacy skills and the detection of fake news.

In addition, there is a research trend that is also popularly used in research in the use of technology to detect fake news since 2021, namely cyber deception. Some studies present a cyber fraud approach that combines reactive (graphic analysis) and proactive (cyber fraud technology) defenses (Al Amin *et al*., 2021). In addition, there are studies to explore cyber fraud approaches from threats that include fraudulent methods (Steingartner & Galinec, 2021). Cyber deception research trends provide opportunities to deter threats that disrupt a system. Therefore, this research trend can be used as an effort to deal with the detection of fake news that can be developed further.

4. CONCLUSION

The overall results of the research have been described in the results and discussions to answer the formulation of the problem and research objectives, so the conclusions from the research presented are the development of research publications in the use of technology for the detection of fake news from 2011 to 2021 showing an increase. From 2011 to 2017, the research publications produced annually were stable. Meanwhile, from 2018 to 2021, there will be an increase in research publications every year. The co-authorship analysis shows that the distribution of items on the visualization map in countries is more displayed than organizational units or authors because of the high inter-collaboration of connections between countries in publishing research documents. Citation analysis shows that the units that account for the majority of research documents based on the number of publications cited do not always have a high number of inter-unit citations. Co-citation analysis shows that the authors and sources with the highest cited publications have a high interconnection of collaboration between authors and sources. The co-occurrence analysis shows that the linkage of keywords in technology use research for fake news detection is not only related to machine learning technology but there are keywords related to literacy skills such as media literacy and information literacy. This research on the use of technology to detect fake news shows several research trends that have been widely used by researchers in the last 2 years, including topics on COVID-19, media literacy, and cyber deception.

5. AUTHORS' NOTE

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article. The authors confirmed that the data and the paper are free of plagiarism.

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p- ISSN 2528-1410 e- ISSN 2527-8045

6. REFERENCES

Al Amin, M. A. R., Shetty, S., Njilla, L., Tosh, D. K., and Kamhoua, C. (2021). Hidden markov model and cyber deception for the prevention of adversarial lateral movement. *IEEE Access*, *9*, 49662–49682.

Al Husaeni, D. N., Nandiyanto, A. B. D., and Maryanti, R. (2023). 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.

Alameri, S. A., and Mohd, M. (2021). Comparison of fake news detection using machine learning and deep learning techniques. *2021 3rd International Cyber Resilience Conference (CRC)*, 1–6.

Alonso, M. A., Vilares, D., Gómez-Rodríguez, C., and Vilares, J. (2021). Sentiment Analysis for Fake News Detection. *Electronics (Switzerland)*, *10*(11), 1-32.

Baptista, J. P., and Gradim, A. (2020). Understanding fake news consumption: A Review. *Social Sciences*, *9*(10), 1–22.

Ben Amram, S., Aharony, N., and Bar Ilan, J. (2021). Information literacy education in primary schools: A case study. *Journal of Librarianship and Information Science*, *53*(2), 349–364.

Bilad, M.R. (2022). Bibliometric analysis for understanding the correlation between chemistry and special needs education using vosviewer indexed by google. *ASEAN Journal of Community and Special Needs Education*, *1*(2), 61-68.

Bondielli, A., and Marcelloni, F. (2019). A survey on fake news and rumour detection techniques. *Information Sciences*, *497*, 38–55.

Carter, M. (2019). Book review: fact vs. fiction: Teaching critical thinking skills in the age of fake news. *Journal of Media Literacy Education*, *11*(3), 98–100.

Choraś, M., Demestichas, K., Giełczyk, A., Herrero, Á., Ksieniewicz, P., Remoundou, K., Urda, D., and Woźniak, M. (2021). Advanced machine learning techniques for fake news (online disinformation) detection: A systematic mapping study. *Applied Soft Computing*, *101*, 107050.

De Vicente Domínguez, A. M., Bañares, A. B., and Sierra, J. (2021). Young Spanish adults and disinformation: Do they identify and spread fake news and are they literate in It? *Publications*, *9*(1), 1–16.

Deroo, M. (2021). Seeking truth about muslims: Critical media literacies in an era of islamophobia. *Journal of Media Literacy Education*, *13*(3), 49–61.

Ding, D., Han, Q. L., Xiang, Y., Ge, X., and Zhang, X. M. (2018). A survey on security control and attack detection for industrial cyber-physical systems. *Neurocomputing*, *275*, 1674–1683.

Donthu, N., Kumar, S., and Pattnaik, D. (2020). Forty-five years of journal of business research: A bibliometric analysis. *Journal of Business Research*, *109*, 1–14.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., and Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296.

DOI: https://doi.org/10.17509/ijost.v7i3.51449
p- ISSN 2528-1410 e- ISSN 2527-8045

Fauziah, A., and Nandiyanto, A. B. D. (2022). A bibliometric analysis of nanocrystalline cellulose production research as drug delivery system using VOSviewer. *Indonesian Journal of Multidiciplinary Research, 2*(2), 333-338.

Gómez-García, G., Hinojo-Lucena, F. J., Cáceres-Reche, M. P., and Navas-Parejo, M. R. (2020). The contribution of the flipped classroom method to the development of information literacy: A systematic review. *Sustainability (Switzerland)*, *12*(18), 1–13.

Guljaš, S., Bosnić, Z., Salha, T., Berecki, M., Krivdić Dupan, Z., Rudan, S., and Majnarić Trtica, L. (2021). Lack of informations about COVID-19 vaccine: From implications to intervention for supporting public health communications in COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *18*(11), 6141.

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

Hirawan, D., Oktafiani, D., Fauzan, T. A., Luckyardi, S., and Jamil, N. (2022). Research trends in farming system soil chemical: A bibliometric analysis using vosviewer. *Moroccan Journal of Chemistry*, *10*(3), 576-590

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

Jiang, T., Li, J. P., Haq, A. U., Saboor, A., and Ali, A. (2021). A novel stacking approach for accurate detection of fake news. *IEEE Access*, *9*, 22626–22639.

Kurniati, P. S., Saputra, H., and Fauzan, T. A. (2022). A bibliometric analysis of chemistry industry research using vosviewer application with publish or perish. *Moroccan Journal of Chemistry*, *10*(3), 428-441

Lim, S. S., and Tan, K. R. (2020). Front liners fighting fake news: Global perspectives on mobilising young people as media literacy advocates. *Journal of Children and Media*, *14*(4), 529–535.

Liu, Z., Yin, Y., Liu, W., and Dunford, M. (2015). Visualizing the intellectual structure and evolution of innovation systems research: A bibliometric analysis. *Scientometrics*, *103*(1), 135–158.

Luckyardi, S., Soegoto, E. S., Jumansyah, R., Dewi, N. P., and Mega, R. U. (2022). A bibliometric analysis of climate smart agriculture research using vosviewer. *Moroccan Journal of Chemistry*, *10*(3), 488-499

Maseda, A., Iturralde, T., Cooper, S., and Aparicio, G. (2021). Mapping women's involvement in family firms: A review based on bibliographic coupling analysis. *International Journal of Management Reviews*, *24*(2), 279-305.

DOI: https://doi.org/10.17509/ijost.v7i3.51449
p- ISSN 2528-1410 e- ISSN 2527-8045

Mihailidis, P., Johnson, P., Ramasubramanian, S., Angove, S., Tully, M., Foster, B., and Riewestahl, E. (2021). Do media literacies approach equity and justice? *Journal of Media Literacy Education*, *13*(2), 1–14.

Mudzakir, A., Rizky, K. M., Munawaroh, H. S. H., and Puspitasari, D. (2022). Oil palm empty fruit bunch waste pretreatment with benzotriazolium-based ionic liquids for cellulose conversion to glucose: Experiments with computational bibliometric analysis. *Indonesian Journal of Science and Technology*, *7*(2), 291-310.

Mukhtar, S., and Putri, K. Y. S. (2021). Technology integrated on media literacy in economic studies on higher education. *Journal of Social Studies Education Research*, *12*(1), 95–123.

Mulyawati, I. B., and 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.

Nandiyanto, A. B. D., Biddinika, M. K., and Triawan, F. (2020). 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., Ragadhita, R., Fiandini, M., Al Husaeni, D. F., Al Husaeni, D. N., and Fadhillah, F. (2022). Domestic waste (eggshells and banana peels particles) as sustainable and renewable resources for improving resin-based brakepad performance: Bibliometric literature review, techno-economic analysis, dual-sized reinforcing experiments, to comparison. *Communications in Science and Technology*, *7*(1), 50-61.

Nandiyanto, A.B.D., Al Husaeni, D.F, and Ragadhita, R. (2023). Bibliometric data analysis of research on resin-based brake-pads from 2012 to 2021 using vosviewer mapping analysis computations. *ASEAN Journal for Science and Engineering in Materials*, 2(1), 35-44.

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 (Kuwait)*, *9*(Special issue), 1-16.

Nandiyanto, A.B.D., and Al Husaeni, D.F. (2022). Bibliometric analysis of engineering research using vosviewer indexed by googles scholar. *Journal of Engineering Science and Technology, 17*(2), 883-894.

Ni, S., Li, J., and Kao, H. Y. (2021). MVAN: Multi-view attention networks for fake news detection on social media. *IEEE Access*, *9*, 106907–106917.

Nobanee, H., Hamadi, F. Y. Al, Abdulaziz, F. A., Abukarsh, L. S., Alqahtani, A. F., Alsubaey, S. K., Alqahtani, S. M., and Almansoori, H. A. (2021). A bibliometric analysis of sustainability and risk management. *Sustainability (Switzerland)*, *13*(6), 1–16.

Nordin, N.A.H.M. (2022). Correlation between process engineering and special needs from bibliometric analysis perspectives. *ASEAN Journal of Community and Special Needs Education*, 1(1), 9-16.

Nugraha, S. A., and Nandiyanto, A. B. D. (2022). Bibliometric analysis of magnetite nanoparticle production research during 2017-2021 using VOSviewer. *Indonesian Journal of Multidiciplinary Research, 2*(2), 327-332.

DOI: https://doi.org/10.17509/ijost.v7i3.51449
p- ISSN 2528-1410 e- ISSN 2527-8045

Okoro, E. M., Abara, B. A., Umagba, A. O., Ajonye, A. A., and Isa, Z. S. (2018). A hybrid approach to fake news detection on social media. *Nigerian Journal of Technology*, *37*(2), 454.

Pinto, M., Fernandez-Pascual, R., and Puertas, S. (2016). Undergraduates' information literacy competency: a pilot study of assessment tools based on a latent trait model. *Library and Information Science Research*, *38*(2), 180–189.

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.

Riandi, R., Permanasari, A., and Novia, N. (2022). Implementation of biotechnology in education towards green chemistry teaching: A bibliometrics study and research trends. *Moroccan Journal of Chemistry*, *10*(3), 417-427.

Rodrigo, P., Arakpogun, E. O., Vu, M. C., Olan, F., and Djafarova, E. (2022). Can you be mindful? The effectiveness of mindfulness-driven interventions in enhancing the digital resilience to fake news on Covid-19. *Information Systems Frontiers*, *0123456789*, 1-21.

Rossetto, D. E., Bernardes, R. C., Borini, F. M., and Gattaz, C. C. (2018). Structure and evolution of innovation research in the last 60 years: review and future trends in the field of business through the citations and co-citations analysis. *Scientometrics*, *115*(3), 1329–1363.

Saleh, H., Alharbi, A., and Alsamhi, S. H. (2021). OPCNN-FAKE: Optimized convolutional neural network for fake news detection. *IEEE Access*, *9*, 129471–129489.

Saputra, H., Albar, C.N., Soegoto, D.S. (2022). Bibliometric analysis of computational chemistry research and its correlation with Covid-19 pandemic. *Moroccan Journal of Chemistry*, *10*(1), 037-049.

Scheibenzuber, C., Hofer, S., and Nistor, N. (2021). Designing for fake news literacy training: a problem-based undergraduate online-course. *Computers in Human Behavior*, *121*, 106796.

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.

Sharma, D. K., Garg, S., and Shrivastava, P. (2021). Evaluation of tools and extension for fake news detection. *2021 International Conference on Innovative Practices in Technology and Management (ICIPTM)*, 227–232.

Sharma, S., and Sharma, D. K. (2019). Fake news detection: A long way to go. *2019 4th International Conference on Information Systems and Computer Networks, ISCON 2019*, 816–821.

Shidiq, A. P. A. (2023). bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSviewer. *ASEAN Journal of Science and Engineering*, *3*(1), 31-38.

Shidiq, A. S., Permanasari, A., and Hernani, S. H. (2021). The use of simple spectrophotometer in STEM education: A bibliometric analysis. *Moroccan Journal of Chemistry*, *9*(2), 290-300.

DOI: https://doi.org/10.17509/ijost.v7i3.51449
p- ISSN 2528-1410 e- ISSN 2527-8045

Soegoto, H., Soegoto, E. S., Luckyardi, S., and Rafdhi, A. A. (2022). A bibliometric analysis of management bioenergy research using vosviewer application. *Indonesian Journal of Science and Technology*, *7*(1), 89-104.

Steingartner, W., Galinec, D., and Kozina, A. (2021). Threat defense: Cyber deception approach and education for resilience in hybrid threats model. *Symmetry*, *13*(4), 597.

Sudarjat, H. (2023). Computing bibliometric analysis with mapping visualization using vosviewer on "pharmacy" and "special needs" research Data in 2017-2021. *ASEAN Journal of Community and Special Needs Education*, *2*(1), 1-8

Ulizko, M. S., Antonov, E. V., Grigorieva, M. A., Tretyakov, E. S., Tukumbetova, R. R., and Artamonov, A. A. (2021). Visual analytics of twitter and social media dataflows: a casestudy of covid-19 rumors. *Scientific Visualization*, *13*(4), 144–163.

Umer, M., Imtiaz, Z., Ullah, S., Mehmood, A., Choi, G. S., and On, B. W. (2020). Fake news stance detection using deep learning architecture (CNN-LSTM). *IEEE Access*, *8*, 156695–156706.

Verma, P. K., Agrawal, P., Amorim, I., and Prodan, R. (2021). WELFake: Word embedding over linguistic features for fake news detection. *IEEE Transactions on Computational Social Systems*, *8*(4), 881–893.

Vishwakarma, D. K., and Jain, C. (2020). Recent state-of-the-art of fake news detection: A review. *2020 International Conference for Emerging Technology (INCET)*, 1–6.

Voinea, C., Vică, C., Mihailov, E., and Savulescu, J. (2020). The internet as cognitive enhancement. *Science and Engineering Ethics*, *26*(4), 2345–2362.

Wiendartun, W., Wulandari, C., Fauzan, J. N., Hasanah, L., Nugroho, H. S., Pawinanto, R. E., and Mulyanti, B. (2022). Trends in research related to photonic crystal (PHC) from 2009 to 2019: A bibliometric and knowledge mapping analysis. *Journal of Engineering Science and Technology*, *17*(1), 0343-0360.

Wirzal, M. D. H., and Putra, Z. A. (2022). What is the correlation between chemical engineering and special needs education from the perspective of bibliometric analysis using vosviewer indexed by google scholar? *Indonesian Journal of Community and Special Needs Education*, *2*(2), 103-110.

Xiao, X., Su, Y., and Lee, D. K. L. (2021). Who consumes new media content more wisely? examining personality factors, sns use, and new media literacy in the era of misinformation. *Social Media and Society*, *7*(1), 1-12.

Zhang, X., and Ghorbani, A. A. (2020). An overview of online fake news: characterization, detection, and discussion. *Information Processing and Management*, *57*(2), 102025.

Zubiaga, A., Aker, A., Bontcheva, K., Liakata, M., & Procter, R. (2018). Detection and resolution of rumours in social media: A survey. *ACM Computing Surveys (CSUR)*, *51*(2), 1-36.

DOI: https://doi.org/10.17509/ijost.v7i3.51449
p- ISSN 2528-1410 e- ISSN 2527-8045