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Radicalism in the Age of Digital Technology: A Bibliometric Study

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ABSTRACT

This study aims to examine the development and trends of research related to radicalism in the context of digital technology. Research data was obtained using the Publish or Perish reference manager application by taking references from journals indexed by Google Scholar. A total of 907 articles relevant to the keywords "Radicalism" AND "Digital Technology" from 2018 to 2023 were collected. The data was then analysed and visualized using the VOSviewer application. The results provide insight into the development of radicalism research in the era of digital technology. Bibliometric analysis reveals year-to-year research trends, the main contribution of citation counts, and the development of key concepts in the literature. The results of this study can provide a foundation for future research into a better understanding of radicalism in the context of digital technology.

1. Introduction

Radicalism has become a major concern in global social and political dynamics [1-3]. The term is often used to describe extreme actions or views that often contradict widely accepted social norms and values. In the western world, the meaning of radicalism has shifted drastically. Before the 19th century, it had positive connotations and correlated with liberal, pro-democratic and progressive politics, but after the 19th century, these connotations turned negative and became equivalent to terms that opposed the establishment and recognized the expansion of the distribution of citizens' rights: anti-liberal, fundamentalist, anti-democratic, and regressive.

In the historical context, radicalism has driven significant changes in various aspects of life, ranging from political changes to cultural changes [4]. However, in the modern era dominated by technology, radicalism has acquired a new platform to develop and spread faster and wider than ever before [5]. Advances in technology and information have become new bridges for the emergence of various types of radical terrorism that have disrupted the peace and security of the nation in recent decades.

The development of digital technology has provided powerful tools for individuals and groups to spread radical ideas [6-8]. With easy access to the internet, social media, and other online

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communication platforms, they can easily plan, create, promote, and coordinate radical actions. This has a significant impact on the dynamics of modern radicalism, which is increasingly developing online. In this context, the role of technology as a catalyst for radicalism cannot be ignored.

Previous research has tried to understand the relationship between radicalism and technology [9-12]. These studies cover various aspects, such as the use of social media by radical groups, the influence of the internet on the radicalization process, and how technology affects the way these groups communicate and coordinate. Although there are several studies that have revealed important findings, the field is still evolving along with technological changes and changing social dynamics. Therefore, this bibliometric review aims to review the existing literature to provide a more comprehensive understanding of the relationship between radicalism and technology in the current context. Detailed information for the bibliometric is shown in Table 1.

Table 1
Previous studies on bibliometric

No	Title	Ref.
1	Involving Particle Technology in Computational Fluid Dynamics Research: A Bibliometric Analysis	[13]
2	Bibliometric Computational Mapping Analysis of Trend Metaverse in Education using VOSviewer	[14]
3	The Use of Information Technology and Lifestyle: An Evaluation of Digital Technology Intervention for Improving Physical Activity and Eating Behaviour	[15]
4	Strategies in language education to improve science student understanding during practicum in laboratory: Review and computational bibliometric analysis	[16]
5	How language and technology can improve student learning quality in engineering? definition, factors for enhancing students' comprehension, and computational bibliometric analysis	[17]
6	Mapping of nanotechnology research in animal science: Scientometric analysis	[18]
7	Scientific research trends of flooding stress in plant science and agriculture subject areas (1962-2021)	[19]
8	Introducing ASEAN Journal of Science and Engineering: A bibliometric analysis study	[20]
9	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with Covid-19 pandemic condition	[21]
10	A bibliometric analysis of materials research in Indonesian journal using VOSviewer	[22]
11	Bibliometric analysis of engineering research using VOSviewer indexed by google scholar	[23]
12	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer	[24]
13	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis	[25]
14	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 with commercial product	[26]
15	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research	[27]
16	Corncob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis	[28]
17	The compleat lextutor application tool for academic and technological lexical learning: Review and bibliometric approach	[29]
18	Use of blockchain technology for the exchange and secure transmission of medical images in the cloud: Systematic review with bibliometric analysis.	[30]
19	Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022.	[31]
20	Digital transformation in special needs education: Computational bibliometrics.	[32]
21	Antiangiogenesis activity of Indonesian local black garlic (Allium Sativum 'Solo): Experiments and bibliometric analysis.	[33]
22	Characteristics of tamarind seed biochar at different pyrolysis temperatures as waste management strategy: experiments and bibliometric analysis.	[34]
23	The compleat lextutor application tool for academic and technological lexical learning: Review and bibliometric approach.	[35]

24	Corncob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis.	[36]

To explore the latest developments in the relationship between the science of radicalism and digital technology, a bibliometric analysis is needed. Bibliometric research has the potential to provide a deeper understanding of the direction of research trends as well as the contributions that have been made in this field. For example, bibliometric research conducted by Nandiyanto & Al Husaeni [22].

This study aims to conduct a bibliometric analysis of articles studying radicalism and digital technology indexed in Google Scholar. The analysis process is carried out by utilizing the Publish or Perish application and VOSviewer. The study's findings are expected to provide a solid foundation for future researchers in examining more specific and related topics in the context of radicalism and digital technology.

2. Methodology

The data used in this study was obtained from journals that have been indexed by Google Scholar. Google Scholar has been used in several previous bibliometric studies to collect research data, as noted in previous studies [22,37]. Detailed information for using bibliometric is explained elsewhere [38,39].

To collect research data, the Publish or Perish reference manager application was used. Publish or Perish allowed the collection of research data from Google Scholar by using relevant keywords [24,40]. After the research data was collected, bibliometric analysis was carried out using the VOSviewer application. VOSviewer is software used to visualize and analyse bibliometric data in the form of maps and networks. Data mapping with VOSviewer has been widely used in bibliometric research to identify trends, linkages, and characteristics of scientific publications [41].

The bibliometric analysis in this study focused on several aspects, including the number of publications, the most prolific authors, the most cited journals, and frequently used keywords. Article data was searched in the Publish or Perish application with the keywords "Radicalism" AND "digital technology" to filter publications according to research needs. The articles used in the study were published between 2018 and 2023. After the article data was collected, it was exported to ".ris" and ".csv" formats. Then, VOSviewer applications were used to perform network visualization, redundant visualization, and density visualization. When visualizing data, keywords with at least three times the frequency were set, and less relevant keywords were removed. In-depth bibliometric analysis of the trends and contributions of radicalism and digital technologies are discussed further in this study.

3. Results

3.1 Publication Data Search Results

Based on data search through the Publish or Perish reference manager application in the Google Scholar database, 907 articles that met the research criteria were collected. The data obtained includes article metadata, including author name, title, year of publication, journal name, publisher, number of citations, article links, and related URLs. Table 2 shows examples of some of the data that were the object of VOSviewer analysis in this study. The sample data consists of the top 21 articles that have the highest number of citations.

Table 2
Publication data on radicalism and digital technology

No.	Writer	Title	Year	Quote
1	I'm Kramnick	Republicanism and bourgeois radicalism: political ideology in England and America late eighteenth century	2019	471
2	S Mohamed, MT Png, W Isaac	Decolonial AI: Decolonial theory as sociotechnical foresight in artificial intelligence	2020	303
3	AG Mahler	From the Tricontinental to the global South: Race, radicalism, and transnational solidarity	2018	243
4	K Grint, S Woolgar	On some neural failures in constructivist and feminist technological analysis	2018	218
5	D Gerwin	Innovation process theory for computer-aided manufacturing technology	2018	209
6	D Rothenberg	Fingertips: Technology and the boundaries of nature	2023	205
7	E Carter	Right-wing extremism/radicalism: Reconstructing the concept	2018	198
8	HD Sears	Sex radicals: Free love in high Victorian America	2021	187
9	J Reich	Failure to disrupt: Why technology alone can't change education	2022	182
10	M Rooduijn, B Burgoon	The welfare paradox: does the unfavourable socioeconomic and sociocultural context deepen or dampen radical left and right voting among the underprivileged?	2018	177
11	T Bennett	Popular fiction: technology, ideology, production, reading	2023	167
12	D DeLeon	America as anarchist: Reflections on indigenous radicalism	2019	145
13	Foreign Minister Manshur, H Husni	Promoting religious moderation through literature-based learning: a quasi-experimental study	2020	140
14	K Andrews	Back to black: Retelling black radicalism for the 21st century	2018	137
15	M Evans	Theory of just war: reassessment	2020	136
16	I Warsah, R Morganna, M Uyun...	The impact of collaborative learning on learners' critical thinking skills	2021	129
17	D Jugend, CJC Jabbour, JAA Scaliza, Rocha Hospital...	The relationship between open innovation, innovative performance, government support and company size: Comparing Brazilian companies embracing different levels of radicalism ...	2018	128
18	M Marable	Speaking truth to power: An essay on race, resistance, and radicalism	2018	126
19	K Payne	Artificial intelligence: a revolution in strategic affairs?	2018	112
20	AR Arifianto	Islamic campus da'wah organizations in Indonesia: Promoters of moderation or radicalism?	2019	110
21	B Jefferson	Digitalization and punishment: Racial criminalization in the digital age	2020	110

3.2 Radicalism and Digital Technologies

Table 3 depicts the development of research on radicalism and digital technology published in Google Scholar-indexed publications. According to the statistics in Table 3, there were 907 research publications published in this domain between 2018 and 2023. 166 articles were published in 2018. The number of publications then fluctuated, with 185 published in 2019, 210 published in 2020, 170 published in 2021, 118 published in 2022, and 58 published in 2023. According to the data, research on radicalism and digital technology was still less exploratory in 2018-2019. However, as seen in Figure 1, there has been a large growth in 2020, despite fluctuation in the next years.

Table 3
Radicalism and the development of digital technology research

Year	Entire
2018	166
2019	185
2020	210
2021	170
2022	118
2023	58

According to Figure 1, research on radicalism and digital technology is still relatively inadequately tracked in the 2018-2019 era. However, in 2020, there has been a huge surge of interest in this topic, with the number declining in the following years.

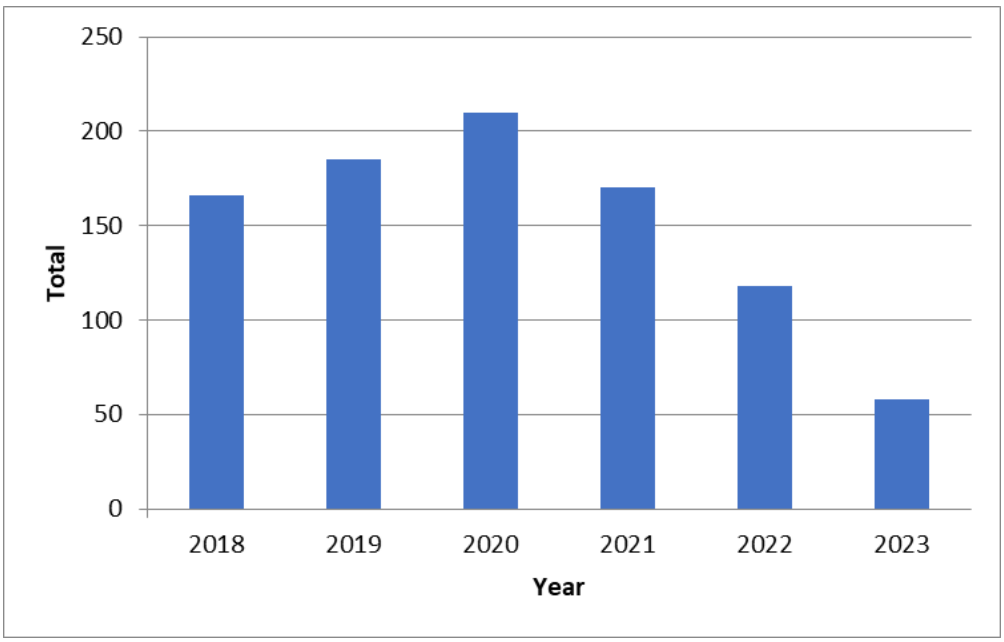

Fig. 1. The level of development of radicalism research and digital technology

3.3 Visualization of Radicalism and Digital Technology Research Topics using VOSviewer

Computational mapping has been done on article data collected using the VOSviewer analysis tool. From this mapping, 249 items related to radicalism research and digital technology were found. The results of this computational mapping illustrate the categorization of mapping data into 14 different clusters, in which each cluster shows the relationship between one term and another. Each cluster includes articles that have a close relationship with this research topic. The identifiable clusters are as follows:

i. Cluster 1 (42 items): access, artificial intelligence, birth, blockchain, contemporary indonesia, current issue, danger, digital literacy, element, essence, evaluation, expression, facebook, fake news, fraudulent practice, gateway, hate speech, hatred, hoax, information culture, information literacy, internet technology, interpretation, link, market, social media, middle, minister, muslims, new approach, pornography, qur, rapid

development, regulation, review, risk, social conflict, social media, speech, technology development, twitter, urgency.

ii. Cluster 2 (34 items): account, aceh, character education, comparative study, degree, dissemination, faculty, goal, high school student, human, human life, important role, isis, Islamic, Islamic state, Jakarta, local wisdom, map, moderate Islam, modernization, number, online radicalism, path, patterns, radicalism ideology, recent year, religious tolerance, researcher, resistance, seed, social network, survey, technology era, west java.

iii. Cluster 3 (27 items): abstract, attention, blockchain technology, consequence, core, covid, current study, evolution, firm, framework, genesis, global problem, governance, industry, international terrorism, moderate Islamic education, openness, pandemic, particular technology, possibility, quality, question, regard, skill, stem, support, university student.

iv. Cluster 4 (24 items): Africa, Australia, chapter, china, Christian radicalism, course, crisis, good, harassment, invention, Islamism, islamist radicalism, root, self, southeact asia, struggle, topic, volume, women, youth radicalism.

v. Cluster 5 (22 items): 21st century, attempt, black radicalism, concept, construction, critical race theory, critique, disruption, india, Indonesia person, Marxism, multicultural education, prevent radicalism, racism, radicalism network, reacon reflection, response, revolution, sense, trade, white supremacy.

vi. Cluster 6 (18 items): attack, author, beginning, company, concern, decade, essay, fascism, feeling, labour, modern technology, perception, political radicalism, race, radical, rhetoric, tradition, turn, war.

vii. Cluster 7 (18 items): ability, addition, assessment, demand, dimension, earth, fight, love, meaning, middle east, principle, protest, radical politics, religious education, social, social movement, technology study, technology transfer.

viii. Cluster 8 (19 items): art, authoritarianism, college, conception, conservatism, educational institution, England, example, honour, institute, interest, mastery, Pakistan, political ideology, product, responsibility, right wing radicalism, structure, united states.

ix. Cluster 9 (17 items): class, competition, experience, gender, individual, Indonesian social media, Islamization, lead, Muhammadiyah, new radicalism, notion, print, region, social radicalism, tempered radicalism, treatment, ulama.

x. Cluster 10 (17 items): activism, bnpt, contestation, discrimination, effectiveness, geography, intention, modernity, opportunity, philosophy, presence, prison, public, radicalism intention, strengthening, uncertainty, west.

xi. Cluster 11 (18 items): civil sphere, da'wah, Europe, face, first, infrastructure, Islamic higher education, jihadism, light, orientation, origin, radio, republic, revitalization, social change, social media technology, sophistication, spirit.

xii. Cluster 12 (15 items): advancement, critical theory, elementary school, family, ICT, internalization, Islamic religious education, limit, media, midst, nature, New York, observation, radicalism content, radicalism prevention.

xiii. Cluster 13 (10 items): adolescent, anti-radicalism, child, climate change, democratic life, engineering, entrepreneurship, mental health, project, theme.

xiv. Cluster 14 (10 items): defence, establishment, future, implication, interview, music, reform, religiosity, religious fundamentalism, representation.

Within each cluster, the relationships between the terms used are displayed visually. In each cluster, these terms are labelled that can be identified through coloured circles. The size of the labelled circles for each term varies depending on the extent to which the term appears in the title

and abstract of the corresponding article. The more often the term appears, the larger the size of the label circle. Mapping visualization consists of three main parts, namely network visualization (see Figure 2), overlay visualization (see Figure 3), and density visualization (see Figure 4). Each part of the visualization provides a different perspective on the relationship between the terms in the study. By using these three parts of visualization, this study can provide a more comprehensive and detailed picture of the relationship between terms in radicalism mapping research and digital technology. Each key concept (keyword) is labelled through coloured circles. The size of the circle is positively correlated with the appearance of keywords in the abstract as well as the title.

Figure 2 shows how the term is related. These relationships are visualized in the form of networks or lines that go from one term to another [22]. Cluster 1 contains keywords from this study consisting of 42 items.

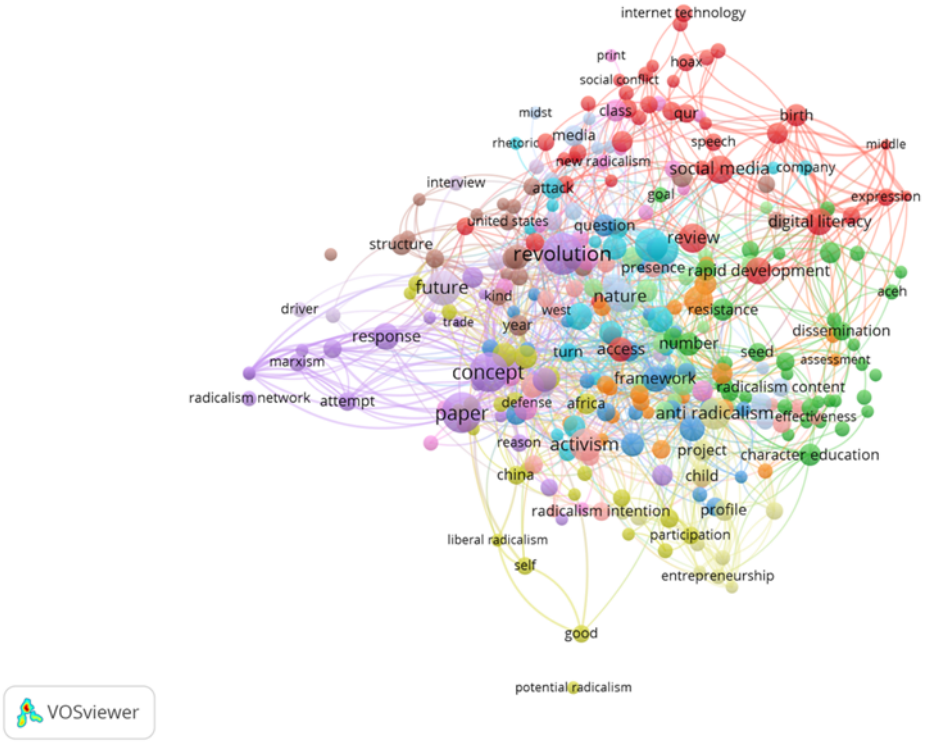

Fig. 2. Network Visualization of radicalism and digital technology

Overlay visualization shows the relationship of a term juxtaposed with the time of research which continues to be updated from year to year. This visualization presentation shows research trends related to radicalism from 2016 to 2021. Research on radicalism in the digital era shown by Figure 3 is in the last 5 years, namely 2019-2021. Based on this visualization, research trends related to radicalism from 2021 to now are in the domain of Education, with several main keywords represented in yellow, namely, antiradicalism, character education, mental health, entrepreneurship, adolescent, democratic life, and project.

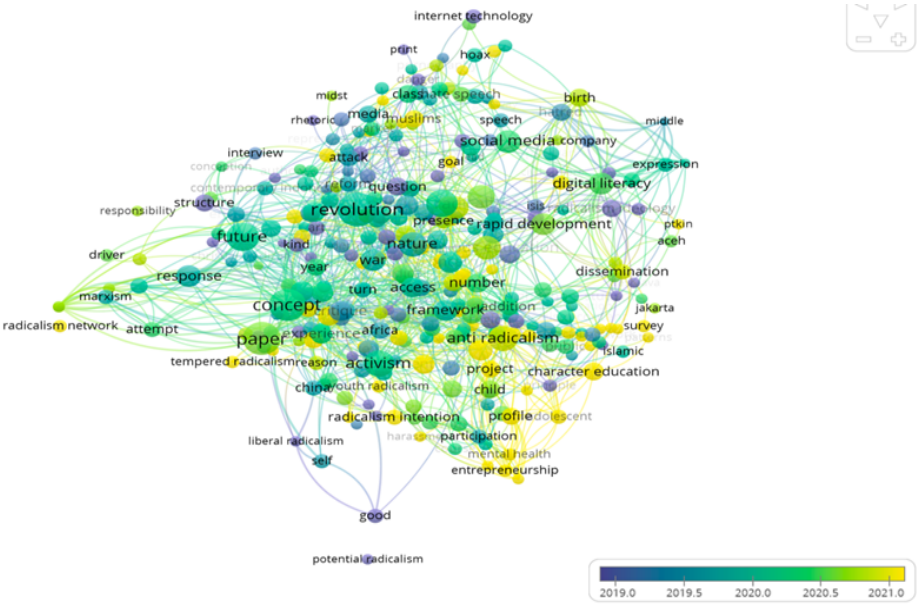

Fig. 3. Overlay Visualization of radicalism research and digital technologies

Figure 4 illustrates the density visualization, which explains that the darker the yellow and the larger the diameter of the circle, the denser the keyword, implying that the keyword is researched more frequently. If the colour fades and blends more with green as the background colour, it indicates less research [22]. Based on the visualization in Figure 4, the terms radicalism and digital technology have the highest amount of research on several main concepts, including antiradicalism, paper, concept, revolution, future, framework, youth radicalism, revolution, and activism.

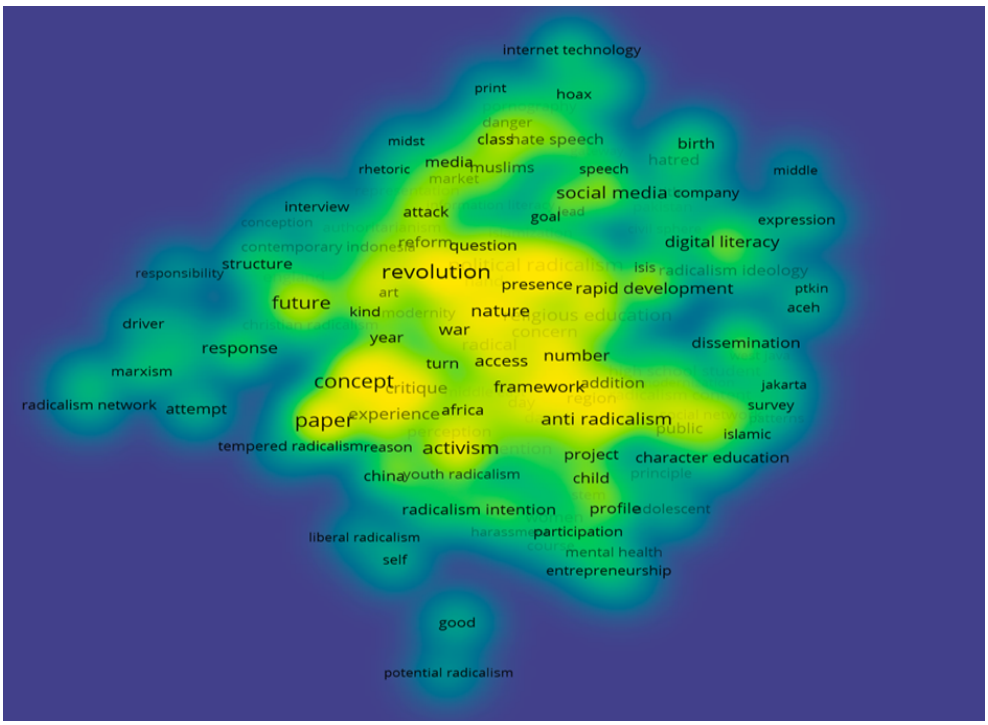

Fig. 4. Visualization of keyword density of radicalism and digital technology

Figure 5 shows that social media is included in keywords that are widely investigated and studied by various groups. Based on the visualization of the image, social media keywords are related to 11

other topics. These keywords are associated with the following terms: digital literacy, expression, hatred, current issue, birth, element, account, contemporary Indonesia, and covid. Based on this, we can map other research related to radicalism that has not been or is still rarely studied, such as potential radicalism, radicalism networks, internet technology, and digital literacy.

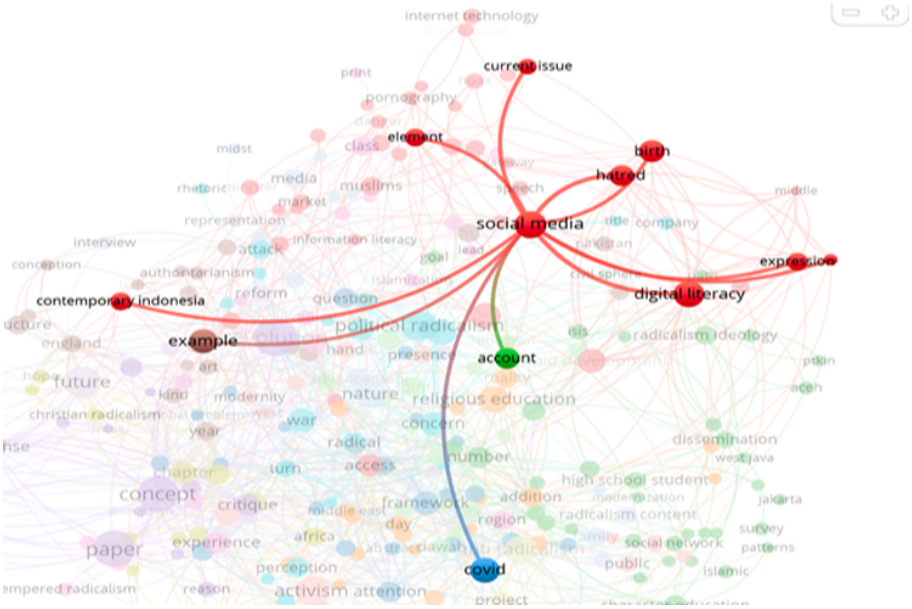

Fig. 5. Visualization of social media networks in the study of radicalism

4. Conclusions

In this bibliometric study, we have uncovered important insights into radicalism in the age of digital technology. The results of the bibliometric data analysis highlight that research related to radicalism and digital technology continues to experience significant growth, reflecting the importance of this topic in the contemporary scientific literature. Based on the search process using the keywords "radicalism" and "digital technology" through the source base of abstracts, keywords and titles, key concepts are often researched such as: antiradicalism, paper, concept, revolution, future, framework, youth radicalism, revolution, activism, and social media. In addition, based on overlay visualization mapping, research trends related to radicalism and digital technology are in several keywords, such as: potential radicalism, radicalism network, internet technology, and digital literacy. These findings provide a deeper understanding of the interaction between radicalism and technology in the digital age. In particular, the results of this study can be a foundation for future research to figure out unexplored aspects and support efforts to understand the phenomenon of radicalism in the context of digital technology development. With constant technological changes and social dynamics, this growing understanding will be invaluable in facing the challenges of radicalism in this digital age.

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