Vol. 07, No. 02, July 2023, pp. 134-144

INTERNATIONAL JOURNAL OF INNOVATION IN ENTERPRISE SYSTEM

Journal homepage: https://ijies.sie.telkomuniversity.ac.id
e-ISSN: 2580-3050, DOI: https://doi.org/10.25124/ijies.v7i02.226

Bibliometric Analysis: Research on Batik in International Publications

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ARTICLE INFO

Article history:
Received 23 May 2023
Accepted 30 July 2023
Published 31 July 2023

ABSTRACT

Batik is an Indonesian cultural tradition that carries profound philosophical meanings embedded in its patterns and high artistic value. This is evident from its early origins when batik was used within a very limited keraton environment. Now it has become a commodity of the Indonesian creative industry that has ventured into the global market. This paper addresses the following issues: the annual number of international scholarly publications in the field of batik to be published in Scopus, the productivity of researchers working in the field of batik, and the methodology for using keywords to map the development of international research publications on batik. Based on the discussion and simulation using VOSviewer software, it can be concluded that the development and growth, especially in the field of batik, from 2012 – 2022, indexed in Scopus, reached 213 publications (18.73%) in 2020. The majority of publications in the field of batik were published in the IOP Conference Series: Earth and Environmental Science. Diponegoro University is the institution that has published the most research in the field of batik, and Indonesia is one of the countries with the highest contributors. The researcher with high productivity in the field of batik is Widiaty, I, with a total of 15 publications from 2012 to 2022, specifically in the field of batik. Regarding the development map of the field of batik based on co-word analysis, there are 7 clusters, where new research topics are identified that can still be further developed, especially in the field of batik

Keywords:
Batik; Bibliometrics; VOSviewer; Scopus; Science Mapping

1. INTRODUCTION

Batik is an Indonesian cultural tradition that carries profound philosophical meanings embedded in its every pattern and high artistic value. Since the Majapahit kingdom era, the Mataram Kingdom in Java, especially the Yogyakarta and Solo palaces, batik has continued to develop and spread to various regions such as Banyumas, Cirebon, and Pekalongan. The development of batik in Indonesia is a hereditary tradition that has become an integral part of the nation's culture [1]. Batik Nusantara has undergone a long journey of growth and development. This is evident from its early origins when batik was used within a very limited keraton environment. Now it has become a commodity of the Indonesian creative industry that has penetrated the global market [2].

According to information gathered by the Ministry of Industry, batik exports reached USD 532.7 million in 2020 and USD 157.8 million in the first quarter of 2021, indicating that the industry has made a significant contribution to the national economy. The development of the batik industry in Indonesia requires attention, particularly towards building a self-reliant and sovereign industry by optimizing domestic resources. There are 47 thousand batik business units in 101 regional centers in Indonesia, predominantly consisting of small and medium-sized enterprises (SMEs) that provide employment for 200 thousand workers [3]. Most Indonesian batik products are made by small and medium-sized industries (SMEs) that are traditionally and downstream managed, and they face their own challenges to compete in the domestic and international markets due to the high competition in the Indonesian batik industry [4]. Free trade and globalization are significant issues for SMEs today. To compete in the market, SMEs must be able to combat the flood of imported goods [5]. The batik industry today faces a considerable challenge with the lack of regeneration of batik artisans among the younger generation [6]. This is due to the fact that many batik artisans switch to other professions and prefer to work outside the area with the hope of earning a large salary [7]. In addition, there are many non-added values that cause waste of energy resources and raw materials and increase the amount of waste produced by batik [8]. Another problem is that the quality inspection process of batik tulis is still done manually with human vision, which of course takes a long time. Inspections performed manually through human eye vision have proven to be ineffective and usually take a lot of time and money [9]–[14]. The other challenge is in terms of the price of batik tulis, which is more expensive because the process of its performance is done manually and takes a long time, so only people in the middle class can enjoy the product of batik tulis [15], [16]. Therefore, there needs to be an effort to preserve the batik of various groups in order for it to exist, grow, be maintained, and be developed.

In order to enhance and preserve literature, it is important to incorporate technology while maintaining the basic principles of literature as well as hand-made items that will preserve cultural values. In addition, batik is also a potential object in the field of research, which attracts the attention of researchers to dig deeper into aspects such as history, cultural values, and batik making techniques. By integrating technology into the writing process, artists can enhance their creativity and efficiency. This can be achieved using digital tools to design complex patterns or modern machines for faster production without sacrificing the authenticity and traditional techniques that make batik unique. The latest advancement in the batik business is batik technology, which allows batik artists to create complex and beautiful batik designs quickly and easily [17]–[21]. Thus, batik has the potential to be an attractive research object for researchers to explore its aspects, which include history, cultural values, and manufacturing techniques. In addition, integrating technology into the process of making batik can also make a positive contribution to the creativity and efficiency of batik artisans.

Research is a scientific activity conducted by institutions, both large (such as those conducted by the state, government, and private organizations) and smaller-scale institutions (such as faculties, universities, and research groups). The availability and reliance on data from scientific research activities are crucial for evaluating research findings. The knowledge that plays a role in evaluating scientific research findings is called bibliometric indicators. Bibliometric indicators also play a role in examining the relationship between technology and science, creating knowledge domain mappings, keeping up with new information developments in specific fields, and, furthermore, serving as guidelines in the future for gaining advantages and making important regulations. There are two approaches used to measure bibliometric indicators, which are typically calculated over a specific period of 3 to 5 years. The first approach is the number of publications, which is used to measure productivity. The second approach is the number of citations, which serves as an indicator of the impact of the generated articles [22].

Bibliometric analysis can be used to determine the direction of future research and as a predictive measurement tool for experimental studies. Statistical bibliometric analysis measures the contribution of scientific articles to specific research topics. Additionally, it reflects the current logical events and can be used to identify expected developments. Therefore, bibliometric analysis can be used to predict future patterns in scientific disciplines [23]. A method called bibliographic research is used to provide a network structure that answers questions such as what topics are most important in a specific field of knowledge, how these topics are interconnected, and how a topic changes over time [24].

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This paper discusses the following issues: how many international scientific publications in the field of batik are published in Scopus each year, the productivity of researchers working in the field of batik, and how to use keywords to map the development of international batik research publications. Through bibliometric analysis, this paper aims to gain in-depth understanding of the topics related to batik and its publications, including citations worldwide. It examines the selection of authors, the frequency and temporal analysis of citations, the relationship between subject areas that drive collaboration, the co-occurrence analysis of keywords used in abstracts, and the clustering analysis of manuscripts in this field. Therefore, this research has future benefits, particularly in assisting new researchers in making wise choices regarding research domains and providing a fundamental understanding of batik research.

2. METHOD

The study of scientific activities through bibliographic analysis is known as bibliometric analysis, which is based on the idea that a researcher conducts their own research and is required to share their findings with others. If researchers collaborate to explore specific research problems, it leads to progress and the growth of knowledge. Certainly, knowledge from previous scientific studies conducted by colleagues is highly necessary in research. Publications are suggested to provide knowledge outputs within the traditional input-output paradigm used to explain the process of scientific research. Most scientific papers and monographs are considered as the final statements of research findings [25].

Most bibliometric studies offer citation analysis of a particular field of study, typically in the form of a top-N list of the publications, authors, or journals that have been referenced the most frequently. Influence is measured by citing sources. An article is considered significant if it receives numerous citations. This approach is predicated on the notion that writers reference works they value highly in their writing. Citation analysis can reveal information about the relative impact of publications, but it cannot reveal linkages within the academic community [26].

There are two main uses for bibliographic methods: science mapping and performance analysis. Performance analysis aims to assess the performance of individuals and institutions in research and publication. The goal of science mapping is to demonstrate the dynamics and structure of scientific fields. When researchers aim to review a specific research field, information about its structure and development is highly beneficial. Subjective evaluations in literature are brought into the realm of quantitative rigidity through bibliometric methods. In review articles, they can demonstrate that theoretically derived categories are valid [27].

Bibliometrics consists of three parts: a) bibliometrics for bibliometricians, which is the main field of bibliometric research and traditionally used as a research methodology; b) bibliometrics for scientific disciplines (scientific information), considering researchers work in scientific-oriented fields, their interest in their specialized areas is strong, and this allows for shared boundaries with quantitative research; and c) bibliometrics for science policy and management (science policy) represents bibliometrics for other scientific disciplines [28].

In this paper, we develop a dataset mapping using VOSviewer. This network can include journals, researchers, or individual articles, as VOSviewer is a free software application for constructing and visualizing bibliometric networks [23], [29]. The network can be built using citations, bibliographic coupling, co-citation, or co-authorship interactions. Furthermore, VOSviewer has text mining capabilities that can be utilized to create and display networks of co-occurring phrases extracted from a large body of scientific literature [23]. VOSviewer has an advantage over other analysis applications as it utilizes text mining functions to discover relevant combinations of noun phrases for mapping and employs an integrated clustering approach to evaluate co-citation network data and co-occurring events [30].

3. RESULT AND DISCUSSION

3.1. Development of Batik Field Publications

From 2012 to 2022, the development and growth of publications in the field of batik have significantly increased. In 2020, there was the highest growth in Scopus-indexed articles, with a total of 213 publications (18.73%). Table 1 illustrates the overall development of international publications in the field of batik.

The development and growth of international publications in the field of batik, based on Table 1 and Figure 1, indicate an upward trend from 2012 to 2022. The highest growth occurred in 2020 with 213 publications (18.73%). This was followed by 2021 (194 publications or 17.06%), 2019 (185 publications or 16.27%), and 2018 (144 publications or 12.66%).

Table 1 - Year of Publications in the Field of Batik in Scopus

No	Year of Publication	Total	Percentage (%)
1	2022	99	8.71
2	2021	194	17.06
3	2020	213	18.73
4	2019	185	16.27
5	2018	144	12.66
6	2017	106	9.32
7	2016	87	7.65
8	2015	45	3.96
9	2014	25	2.20
10	2013	14	1.23
11	2012	25	2.20
	Total	**1137**	**100.00**

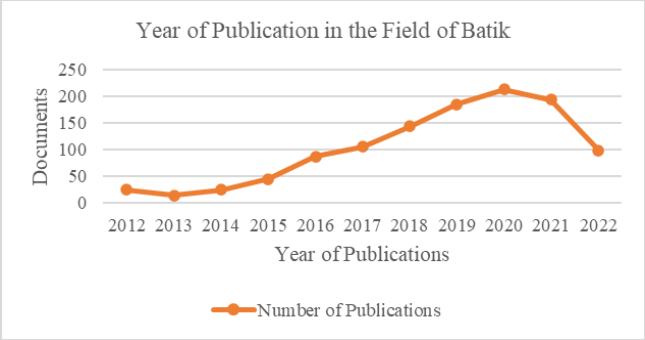

Figure 1 - Year of Publications in the Field of Batik in Scopus

3.2. Core Journals in the Field of Batik

Out of a total of 1345 publications found in Scopus using the keyword "Batik" as a search term, it is widely known that the core journal IOP Conference Series Earth and Environmental Science publishes most international publications in the field of batik (124 publications). Table 2 lists the top ten core journals covering developments in the field of instrumentation.

Table 2 - Core Journals in the Field of Batik in Scopus

No	Core Journals	Total
1	IOP Conference Series Earth and Environmental Science	124
2	Journal of Physics Conference Series	94
3	AIP Conference Proceedings	63
4	IOP Conference Series Materials Science and Engineering	54
5	Advanced Science Letters	19
6	E3s Web of Conferences	19
7	Journal of Theoretical and Applied Information Technology	19
8	Surface Design Journal	19
9	International Journal of Scientific and Technology Research	15
10	Textilkunst International	14

Based on Table 2 and Figure 2, it can be observed that after IOP Conference Series Earth and Environmental Science, other publications also publish in the field of batik. These include Journal of Physics Conference Series (94 publications),

AIP Conference Proceedings (63 publications), IOP Conference Series Materials Science and Engineering (54 publications), and Advanced Science Letters (19 publications). Among all the international publications in Figure 3 related to the field of batik, 53% are articles, 40% are conference papers, 3% are book chapters, 2% are conference papers, and 1% consist of reviews and short reviews.

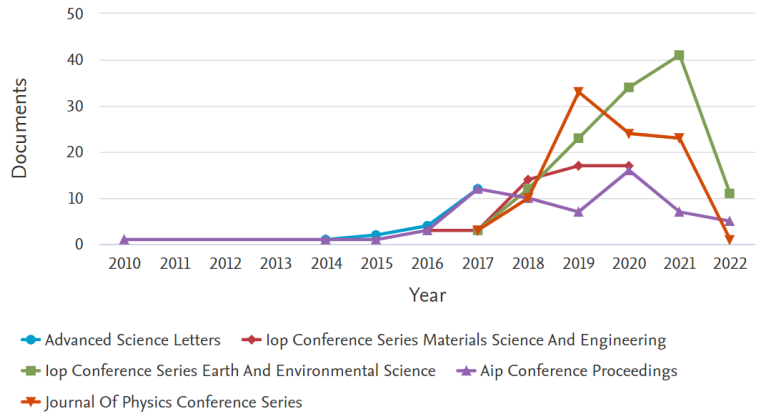

Figure 2 - Core Journals in the Field of Batik in Scopus

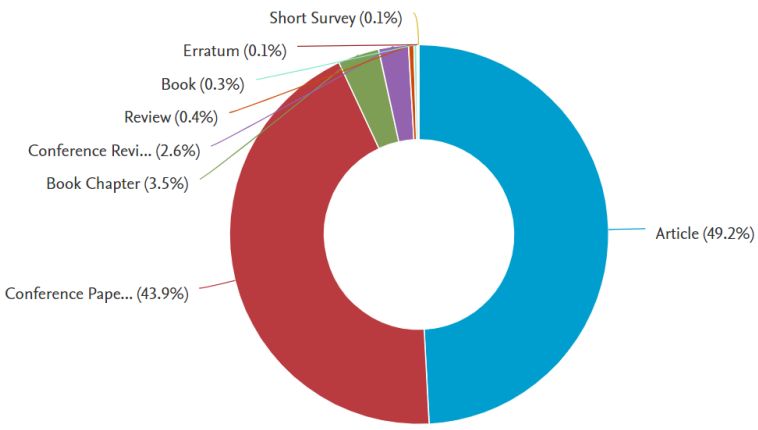

Figure 3 - Document Types

3.3. Publishers in the Field of Batik

Based on the findings of the data analysis, Diponegoro University is the institution that publishes the most research on batik. Table 3 shows the top ten institutions that publish research in the field of batik.

Table 3 - Publishers in the Field of Batik

No	Publisher/Affiliation	Total
1	Universitas Diponegoro	89
2	Universitas Sebelas Maret	84
3	Universitas Gadjah Mada	50
4	Universitas Islam Indonesia	48
5	Universitas Negeri Semarang	41
6	Institut Teknologi Bandung	37
7	Universitas Indonesia	36
8	Universitas Jenderal Soedirman	34
9	Universiti Teknologi MARA	32
10	Institut Teknologi Sepuluh Nopember	32

In Table 3 and Figure 4, it can be observed that Diponegoro University is the institution that publishes the most research results, particularly in the field of batik, with a total of 89 publications from 2012 to 2022. It is followed by Sebelas Maret University with 84 publications, Gadjah Mada University with 50 publications, Islamic University of Indonesia with 48 publications, Semarang State University with 41 publications, and other universities that make it to the top 10 publishers in the field of batik.

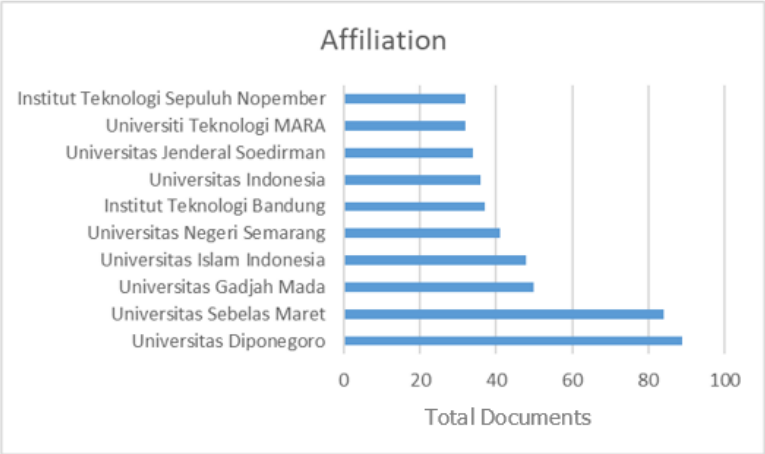

Figure 4 - Publishers in the Field of Batik

3.4. Productivity in Batik Research

The productivity of researchers in the field of batik, indexed in Scopus, from 2012 to 2022, is evident in the top 10 highly productive researchers with a production ranging from 8 to 15 publications, as shown in Table 4.

Table 4 - Researchers' Productivity in the Field of Batik

No	Authors	Total
1	Widiaty, I.	15
2	Suciati, N.	13
3	Minarno, A.E.	12
4	Mubaroq, S.R.	10
5	Abdullah, A.G.	9
6	Muafi	9
7	Susanty, A.	9
8	Dewi, R.S.	8
9	Harjoko, A.	8
10	Kusuma, P.D.	8

Based on Figure 5, it can be observed that the productivity of researchers in publishing indexed Scopus publications, particularly in the field of batik, is remarkably high. Widiaty, I have produced 15 publications, Scuiati, N has produced 13 publications, Minarno, A. E. has produced 12 publications, and Mubaroq, S.R. has produced 10 publications. Other researchers, such as Abdullah, A.G., Muafi, and Susanty A., have produced 9 publications, while Dewi, R.S., Harjoko, A., and Kusuma, P.D. have an average of 8 publications.

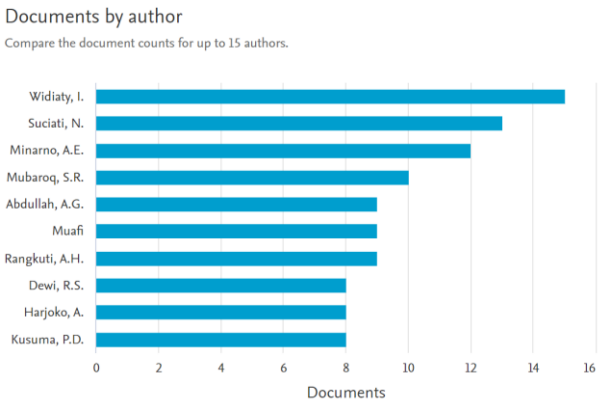

Figure 5 - Researchers' Productivity in the Field of Batik

3.5. Countries with Scopus-Indexed Publications

Indonesia has the highest number of contributors to Scopus-indexed batik research, followed by Malaysia, China, the United States, and the United Kingdom. Other countries that have contributed to research in the field of batik indexed in Scopus can be seen in Table 5.

Table 5 - Countries as Publishers in the Field of Batik

No	Countries	Total
1	Indonesia	880
2	Malaysia	134
3	China	36
4	Australia	14
5	Thailand	13
6	India	11
7	Japan	11
8	United States	10
9	United Kingdom	7
10	Netherlands	5

According to Table 5, it can be observed that Indonesia contributes the highest number of publications resulting from research in the field of batik, with a total of 880 publications. The following countries are Malaysia (134 publications), China (36 publications), Australia (14 publications), and Thailand (13 publications). Figure 6 demonstrates that the increasing intensity of the yellow color indicates a higher number of publications in the field of batik. Additionally, this represents a significant opportunity for each country to further develop research related to batik.

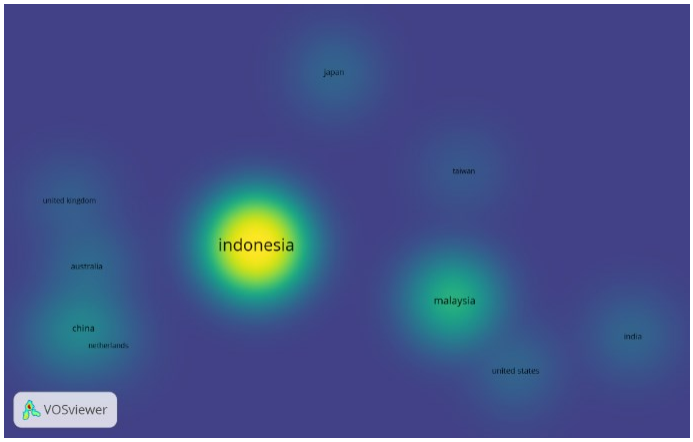

Figure 6 - Countries as Publishers in the Field of Batik

3.6. Subjects of Publications in the Field of Batik

The subject area "Engineering" is the highest in terms of indexed Scopus subjects from 2012 to 2022. It is followed by other subject areas such as "Environmental Science," "Computer Science," and "Social Sciences." Table 6 displays the number of research publications in the field of batik.

Table 6 - Subject Areas of Publications in the Field of Batik

No	Subject Areas	Total
1	Engineering	326
2	Environmental Science	255
3	Computer Science	232
4	Social Sciences	210
5	Physics and Astronomy	180
6	Business, Management and Accounting	175
7	Earth and Planetary Sciences	154
8	Materials Science	137
9	Arts and Humanities	79
10	Mathematics	74
11	Energy	73
12	Economics, Econometrics and Finance	71
13	Chemical Engineering	60
14	Decision Sciences	55
15	Agricultural and Biological Sciences	45
16	Chemistry	36
17	Medicine	32
18	Biochemistry, Genetics and Molecular Biology	28
19	Multidisciplinary	16
20	Pharmacology, Toxicology and Pharmaceutics	16
21	Psychology	6
22	Nursing	5
23	Immunology and Microbiology	4
24	Health Professions	2
25	Veterinary	1

Figure 7 illustrates the subjects of publications in the field of batik from 2012 to 2022 in descending order. The highest number of publications belongs to the subject of Engineering (14.3%), followed by Environmental Science (11.2%), Computer Science (10.2%), Physics and Astronomy (7.9%), and Social Sciences (9.2%).

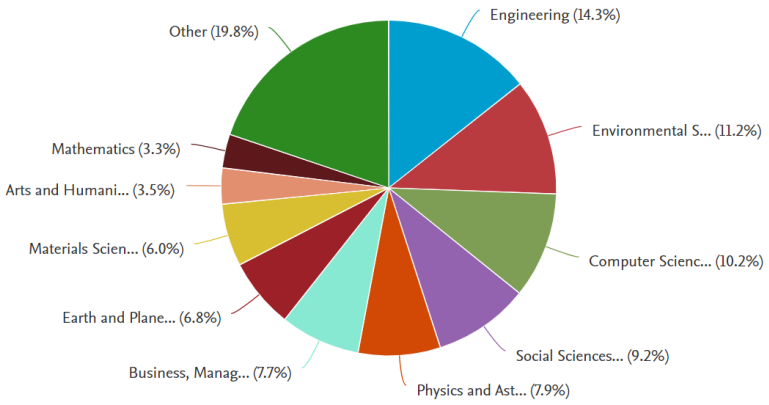

Figure 7 - Subjects of Publications in the Field of Batik

3.6. Map of Publication Development Based on Keywords

Figure 8 shows the map of publication development based on co-word analysis in the field of batik from 2012 to 2022, forming 7 clusters. Cluster 1, represented by the red color, is associated with keywords such as Indonesia, sustainable development, small and medium enterprises, innovation, batik industry, planning, product design, production process, marketing, and pollution control. Cluster 2, represented by the green color, is associated with keywords such as textile industry, wastewater treatment, textiles, dye, chemical oxygen demand, wastewater, batik wastewater, effluents, adsorption, and waste treatment. Cluster 3, represented by the dark blue color, is associated with keywords such as cultural heritages, information systems, extraction, textures, feature extraction, classification (of information), image enhancement, image classification, neural networks, and image processing. Cluster 4, represented by the yellow color, consists of keywords such as color, dyeing, dyes, synthetic dyes, vat dyes, natural dye, natural dyes, information use, cotton, and green manufacturing. Cluster 5, represented by the purple color, consists of keywords such as batik, wax, design, semantics, Southeast Asia, Java, fashion, textile art, traditional textiles, and fabric. Cluster 6, represented by the aqua blue color, includes keywords such as article, human, humans, Malaysia, controlled study, female, male, adult, employment, and cross-sectional study. Cluster 7, represented by the orange color, is associated with the keyword rivers.

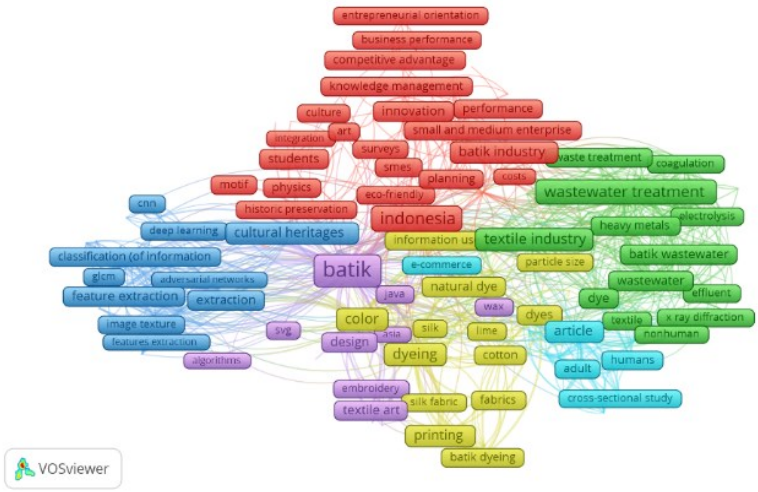

Figure 8 - Co-Word Map of Publications in the Field of Instrumentation

Figure 9 depicts the related topics of batik from before 2010 to 2022. There are new topics emerging, such as dissolved oxygen, worker, intangible cultural heritages, major clinical study, CNN (Convolutional Neural Network), phytoremediation, human experiment, open innovation, and convolutional neural network. This is based on the average publication values per year. Some research topics related to batik, particularly in the field of engineering, include the use of deep learning methods for batik classification [31]–[35].

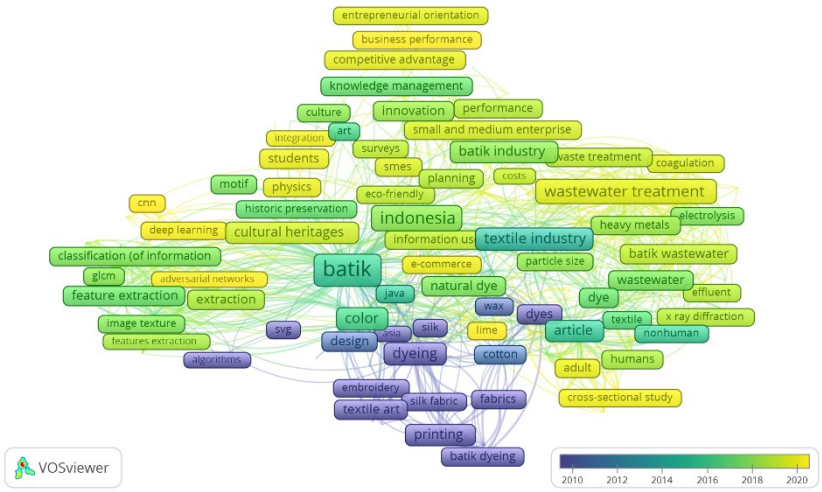

Figure 9 - Published Articles

4. CONCLUSION

Based on the discussion and data analysis using VOSviewer, it can be concluded that the development and growth, particularly in the field of batik, indexed in Scopus from 2012 to 2022, reached its peak in 2020 with 213 publications (18.73%). A significant number of publications in the field of batik were published in the IOP Conference Series Earth and Environmental Science. Diponegoro University is the institution that publishes the most research in the field of batik, and Indonesia is one of the countries with the highest contributors. A highly productive researcher in the field of batik is Widiaty, I, with a total of 15 publications from 2012 to 2022, specifically in the field of batik. For the co-word map of the development in the field of batik, there are 7 clusters, where new research topics emerge that can still be further developed, particularly in the field of batik. Additionally, the addition of keywords is needed to encourage more comprehensive research, especially in the field of batik.

Acknowledgement

The authors thank the Center for Education Financial Services (Puslapdik), Indonesia Endowment Funds for Education (LPDP), and Telkom University for financial support for this study.

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