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Research Mapping on Batik in Scopus-Indexed Publications

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ABSTRACT

This research aims to survey the field of batik-related studies within the Scopus database. The chosen methodology involves bibliometric analysis, utilizing the keyword "*Batik*" to gather data from Scopus. The collected data is then processed and examined through the Publish or Perish and VOSviewer applications to present visualization results. The findings of the study reveal a surge in scientific publications on *batik* in 2020, totaling 215 documents. Notably, Widiaty emerges as the most prolific author, contributing 16 papers. Indonesia stands out as the leading country in producing publications on *batik*, with Diponegoro University being the most affiliated institution. Scientific articles represent the predominant document type, accounting for 731 reports. Among these, documents categorized as "All Open Access" reached 66 in number. The total number of citations from 1901 to 2023 amounts to 5,414, with an average of 44.38 citations per year and 3.87 citations per article or document. The highest number of article citations, 405, was recorded for Syakur et al. in 2018. Furthermore, various citation metrics were assessed, including an h-index of 27, g-index of 45, hI norm of 17, HLA of 0.14, and hA-index of 9.

Keywords: Bibliometric; research trends; batik

1. INTRODUCTION

Indonesia is known as a country with cultural diversity. One of Indonesia's cultural heritages, which is a symbol of national identity, is *Batik* - a beautiful cloth with patterns that have a deep meaning and high artistic value, part of Indonesian (especially Javanese) culture (Taufiqoh et al., 2018). *Batik* has become a rich and valuable cultural heritage for Indonesia. This art has existed for centuries and has become an essential identity for Indonesian people. This heritage is appreciated as a beautiful art and has significant historical, cultural, and economic value. It is a unique and distinctive expression of folk art, reflecting the importance of Indonesian people's lives (Suryanto, 2017).

Batik, acknowledged globally as an emblem of Indonesian national identity, has gained international recognition through its inclusion in the Memory of the World (MOW) registry by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Following Keris and Wayang, Batik holds the distinction of being the third intangible cultural heritage. The Memory of the World represents collective human memory, encompassing documentary heritage in various formats such as audio, visual, audio-visual, and printed materials, serving as legal evidence of impactful events in human history. MOW shows the uniqueness of human cultural heritage in the form of new thoughts, discoveries, and all forms of heritage that benefit civilization. The MOW program was formed by UNESCO in 1992 to increase world community awareness of the existence and meaning of world heritage. The cultural heritage must be documented in textual, non-textual, and electronic files. MOW's mission is to identify cultural heritage, facilitate preservation processes, promote access to recorded heritage, and raise awareness among the world's people about the existence and meaning of documented cultural heritage.

The terms and conditions for proposing a document as MOW on the site http://mow-indonesia.lipi.go.id/sepintas-tentang-memory-of-the-world/ namely first, belong to all humanity even though legally it may belong to an individual, community organizations, or nations that are part of the documentary heritage. Second, the proposal must include the importance of documentary heritage, access procedures and preservation. Third, collections owned jointly by several countries can be filed together. Fourth, the essential selection criteria that must be met for cultural material to be registered in the MOW are originality, uniqueness, the significance of time, place, subject, theme, and risk of damage. Sourced from the website of the Ministry of Education and Culture regarding the Journey of Batik to Become a World Cultural Heritage, it is known that registration was carried out on September 3, 2008; the Government registered *Batik* on the list of Humanitarian Heritage for Oral and Intangible Culture to UNESCO. UNESCO officially accepted registration from the Government of Indonesia on January 9, 2009. Then in May 2009, a closed submission was made by UNESCO, and on October 2, 2009, UNESCO officially confirmed Indonesian *Batik* in the list of Humanitarian Heritage for Oral and Intangible Culture in Abu Dhabi, United Arab Emirates.

According to Siregar et al., (2020), The estimated count of *batik* industries in Indonesia has reached 6,120 units, sustaining a workforce of 37,093 individuals and generating a monthly production value of approximately 407.5 billion rupiahs. This translates to an annual equivalent of 4.89 trillion rupiahs. Furthermore, Siregar et al., concluded that efforts to develop the *batik* industry in Indonesia continue to be carried out by renewing the printing of the *batik* industry, coordinating the *batik* database system, using natural dyes, optimizing industrial development, socializing the potential of *batik*, processing waste, strengthening the brand of written batik and stamped *batik*, as well as advocacy and social marketing to consumers regarding hand-written and stamped *batik*. Apart from that, it is necessary to map and analyze the value chain of *batik* products in *batik* industry centres to find out the distribution map of **batik** cloth, starting from raw materials, the production process, to the distribution stage, so that it can increase added value for customers and streamline costs incurred (Nugraheni et al., 2022).

Batik can be studied from various aspects, ranging from history, culture, economics, industry, design, labour, art, innovation, technology, and other aspects. This study aims to map research on *batik* in Scopus-indexed international publications, especially in terms of the distribution of documents related to batik in the Scopus database. In addition to knowing the most productive authors, document distribution by country and affiliation, document type, open access type, subject area, citation analysis on publications about *batik*, and publication trends about *batik* based on the appearance of keywords and by year of publication.

This study uses bibliometric analysis. Bibliometric analysis can be used in various types of research, including scientific research, social research, and business research and in this case, focuses on research outcomes on *batik* in the form of publications published in Scopus-indexed journals. Bibliometrics can help researchers identify trends in scientific publications,

measure the impact of research, and identify collaborations between researchers (Moed et al., 2005). Bibliometric analysis is commonly used to evaluate research performance, identify research trends, and map research networks (Perianes-Rodriguez et al., 2016). Research mapping carried out using bibliometric analysis is only for scientific publications that are registered in certain bibliographic databases (Bornmann & Leydesdorff, 2014).

Several studies regarding research mapping used the bibliometric analysis method, including research conducted by Tupan (2020) regarding Bibliometric Mapping of the Development of Open Science Scientific Publications for the 2000-2019 Period. The data is open science publication data from the last 20 years (2000-2019). The results showed that the highest growth of Scopus-indexed publications regarding open science occurred in 2018, with a total of 230 publications. The core journal that publishes the most publications on open science is Royal Open Science, with 26 publications. The United States is the country of origin for the most prolific writers publishing 476 publications. The most prolific author writing about open science is Indiana University's Quick R. Visualization using VOSviewer shows that the development map of scientific publications about open science is divided into 6 clusters. Next, research was conducted by Karim & Soebagyo (2021) regarding the Bibliometric Mapping of Applied Mathematical Research Trends in Google Scholar using VOSviewer. This research focuses on mapping applied mathematics research based on Google Scholar data. Data was collected using the Publish or Perish (PoP) application. Data analysis was carried out descriptively based on the year of publication, publisher's name, researcher productivity, and applied mathematics research trends. The study results illustrate that the trend of applied mathematics publications from 2005-2021 has decreased linearly. The number of publications increased by 68 articles in 2007 published by Elsevier. The most prolific researcher is Dr S. Arulselvi, publishing six articles. The results of the VOSviewer visualization show that applied mathematics research that is rarely researched is research related to domain decomposition, numerical solutions, and the homotopy perturbation method.

Based on the background that has been described, this study aims to explore diverse research data on *batik*, particularly within the realm of international publications indexed in Scopus. The investigation involves mapping the landscape of *batik*-related research to gather insights from a broad spectrum of global scholarly contributions.

2. METHODS

This study uses the bibliometric method by analyzing the trend of publications about batik in international journals indexed by Scopus. This method was chosen because it can provide an overview of a research field that can be identified from publications (Merigó & Yang, 2017). In general, bibliometrics is a branch of library and information science that studies the contents of a bibliography using quantitative methods (Broadus, 1987; Pritchard, 1969). Bibliometric analysis is a descriptive study method that can be used to see the distribution of the number of publications and citations of various kinds of literature, authorship analysis, citation analysis, author collaboration, literature obsolescence, factors, etc. Furthermore, bibliometric analysis topics can be described quantitatively and qualitatively (Velasco et al., 2012).

Table 1. Steps in collecting and analyzing research data

The Stages	Information
Determining the research topic	Research on *Batik*
Selection of data sources	Scopus
Determining keywords	Batik
Determining publication period	Earliest publication until 2022
Data search results	Search results are exported to .RIS format
Data processing	Data is converted into graphs

Data analysis	RIS files are opened using the Publish or Perish
Data visualization	using the VOSviewer application

Data collection was carried out on June 3, 2023, by searching the Scopus database with the keyword "*Batik*". The search results were then filtered using the year, from the initial year (1901) to 2022. The data obtained were 1400 publication documents about *batik*. The collected data is then stored in the form. RIS and processed using the Publish or Perish (PoP) application to obtain a citation matrix for publications about *batik.* The citation matrices obtained include data on publication years, citation years, articles (papers), journal citations per year (cites/year), citations per article (cites/paper), citations per author (cites/author), articles per author (papers/author), number of authors per article (author/paper), h-index, g-index, hI, norm, and hI, annual.

The presentation of data in the form of visualization is processed and analyzed using the VOSviewer application. The results of the visualization of all information about publications that have been collected related to the field studied include bibliographic pairs of authors, countries, institutions, journals and co-occurrence of author keywords (Orduña-Malea & Costas, 2021; Oyewola & Dada, 2022; van Eck & Waltman, 2017).

3. RESULTS AND DISCUSSION

Distribution of research on Batik in the Scopus Database

Publications on *Batik* in the Scopus database have been recorded since 1901. The oldest publication is in the form of a document published by the media, "Koloniale Chronicle", written by Quarles van Ufford (1901).

KOLONIALE KRONIEK.

KOLONIALE LITERATUUR.

Een „Koloniale Raad" of eene „Kamer voor Nederlandsch-Indië? — Nogmaals de heer VAN KOL *in en buiten het Parlement. — Iets over den uitslag der Kamerverkiezingen en den nieuwen Minister van Koloniën. — De Vereeniging „Oost en West", haar orgaan en hare Tentoonstelling van Oost-Indische Weefsels en Javaansche Batiks. —* ROUFFAER'S *„De Batikkunst in Ned.-Indië en hare geschiedenis". — De ambtenaarsopleiding. — Geschriften van en over* F. FOKKENS. — ELINK SCHUURMAN'S *De koffieculture in Brazilië. — Het maandschrift „Onze Eeuw". — Exploitatie van Poeloe Weh. — Uitbreiding onzer handelsbetrekkingen met Oost-Azie. — Vijftigjarig bestaan van het Koninklijk Instituut v/d T. L. & V. v. N.-I. — Verzoek aan de redactiën van de „Semarang-Courant" en van het „Soerabaiasch Handelsblad".*

Figure 1. Koloniale Kroniek 1901

Between 1901 and 2022, a total of 1,400 publications on batik documents have been recorded. Notably, there has been a substantial upward trend in publications related to batik since 2013, starting with 15 documents and progressively rising to 215 documents by 2020. Further details on the publication trends of batik-related documents over the last decade are illustrated in Figure 2.

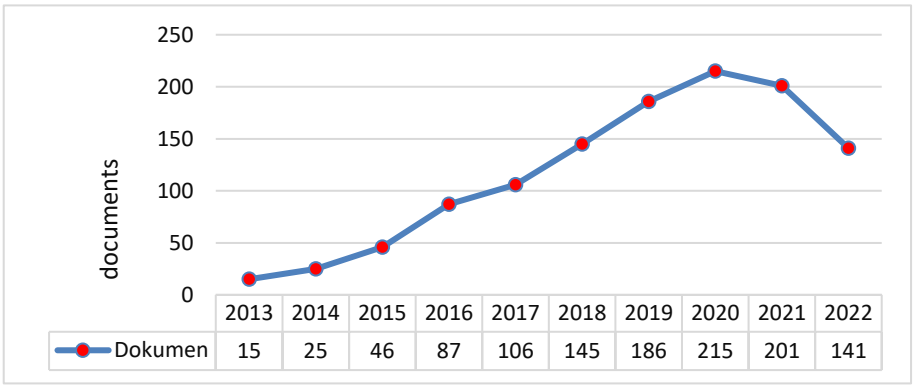


Figure 2. Documents in the last ten years

Based on data analysis, information was obtained about the distribution of articles by the author. It was recorded that 10 (ten) names of the most productive authors wrote articles on *batik* topics. Widiaty is the most prolific author resulting 16 documents, followed by Suciati with 13 documents, and Minarno with 12 documents. The ten most prolific authors as seen in Figure 3.

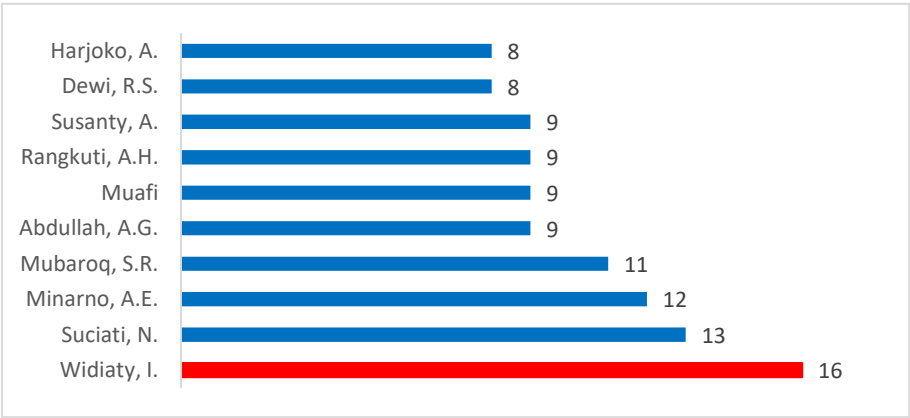


Figure 3. List of 10 prolific authors

Distribution of Documents by Country and Affiliation

The distribution of documents regarding *batik* can also be seen from the country of origin and the authors' affiliation. Indonesia emerges as the predominant contributor, presenting 925 documents. Following closely, Malaysia secures the second position with 152 documents, while China occupies the third spot with 46 documents. Noteworthy is the global participation, extending beyond the Asian Continent to include countries from diverse regions such as the Americas, Europe, and Africa. Figure 4 shows comprehensive insights into the distribution of documents based on the authors' country of origin.

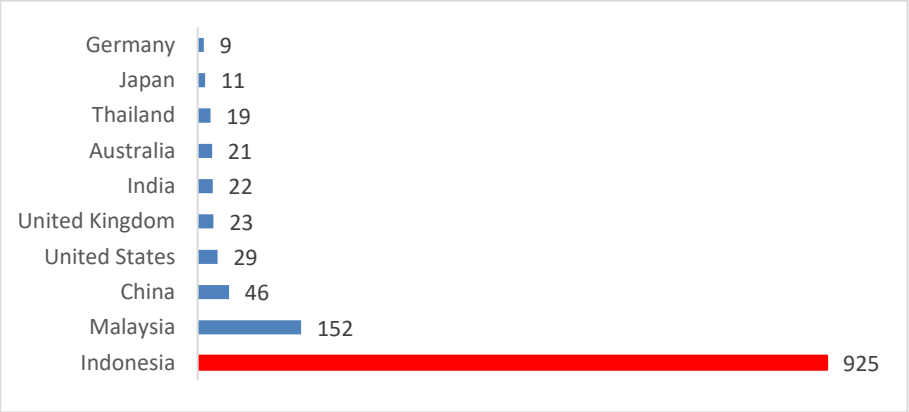


Figure 4. List of 10 prolific authors

Indonesia rightfully holds the foremost position in publications about *batik*, a natural circumstance given that *batik* is a cultural heritage originating from the country. Consequently, research related to batik has become a focal point for Indonesian researchers. Beyond country of origin data, Figure 5 illustrates the identification of author affiliations, providing further insight into the entities contributing to the discourse on batik.

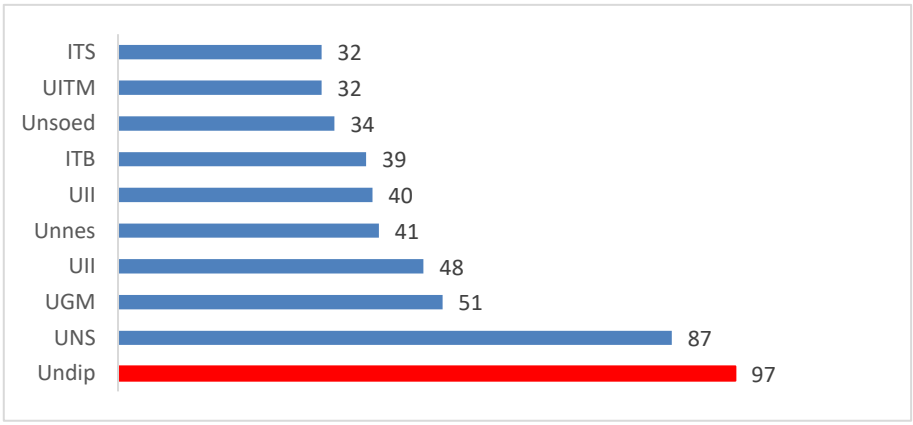


Figure 5. Distribution of documents by authors' affiliations

Figure 5 presents the affiliations of the top 10 authors who frequently publish documents on *batik*. Notably, 9 out of the 10 author affiliations are attributed to universities in Indonesia, while one institution is based in Malaysia. Diponegoro University secures the top position with 97 documents, followed by Sebelas Maret University in second place with 87 documents, and Gadjah Mada University in third place with 51 documents. This distribution underscores the significant contribution of Indonesian academic institutions to the body of knowledge on *batik*.

Document Type and Open Access Type

Judging from the document type, publications about batik are divided into nine types: articles, conference papers, book chapters, conference reviews, reviews, short surveys, books, notes, and erratum. A brief explanation of each type of document: An article is a document published in a scientific journal. A conference paper is a document published from the results of the conference. A book chapter is a document containing a collection of several manuscripts on a specific theme that is made like a book with several chapters. The conference review is in the form of a conference review result text; the review is a document resulting from a review, and the short survey is a document resulting from a short survey. A book is a document in the form

of a book, a note is a document in the form of notes, and erratum refers to a manuscript in which there are corrections made to the article by the publisher so that any corrections must be with the approval of the author before being republished.

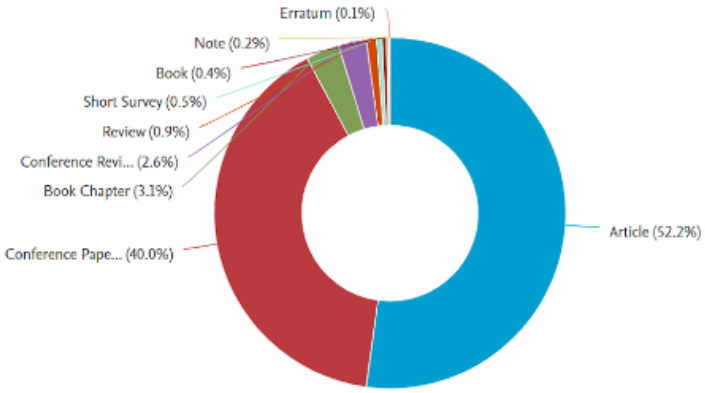


Figure 6. Document types

Document types in the form of scientific articles are the largest, with 731 articles (52.2%), conference papers with 559 documents (40.0%), book chapters with 44 documents (3.1%), conference reviews with 36 documents (2.6%), reviews with 13 documents (0.9%), short surveys seven documents (0.5%), books six documents (0.4%), notes three documents (0.2%), and erratum 1 document (0.1%). The document-type percentage graph can be seen in Figure 6.

In December 2020, Scopus introduced the Open Access (OA) filter by providing several types of open access options in data search. The released classification system includes searching documents using the Gold OA, Hybrid Gold OA, Green OA, Bronze OA and All Open Access Article filters (Aulianto et al., 2019). Gold OA means that the version of the document is available on the publisher's platform, complete with Creative Commons license attributes, and documents in the journal are only open access. Hybrid Gold OA means that the document version is available on the publisher's platform complete with Creative Commons license attributes, and the journal's documents result from the choice of authors who publish in open access. Bronze OA means the version of the manuscript that is declared published by the publisher and will be given temporary or permanent free access. The Green OA version of the published document or accepted manuscript is available in the repository. The author or publisher places the version of the article published in the subscription journal in a freely accessible archive (Solomon, 2013).

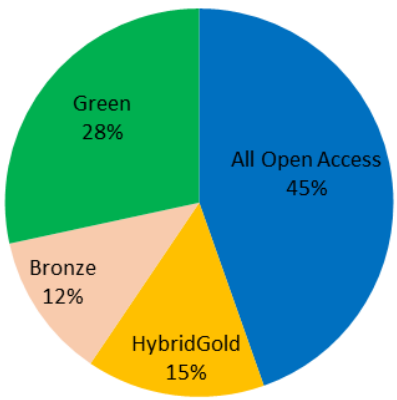


Figure 7. Types of open access

As depicted in Figure 7, from 2012 to 2021, the data reveals that documents categorized under the "All Open Access" access type were the most prevalent, constituting 45% of the total with a count of 66 documents. The "Green Open Access" category accounted for 28%, encompassing 42 documents, while the number of Hybrid Gold OA documents stood at 22. Additionally, there were 18 documents classified under bronze OA. These percentages provide a clear snapshot of the distribution of documents across different open access categories during the specified timeframe.

Subject Areas

Publications on *batik* undergo across various subject areas, and the outcomes of this analysis are visually represented in Graph 7. This mapping delineates the distribution of *batik*-related publications according to distinct subject areas, providing a comprehensive overview of the diverse academic domains contributing to the discourse on *batik*.The subject areas that most often discuss the topic of *batik* are Engineers by 14% (381 documents), Environmental Science 10.4% (284 documents), Computer Science 9.7% (265 documents), Social Science 8.8% (239 documents), Materials Science 8.3% (227 documents), Business, Management and Accounting 8.1% (221 documents), Physics and Astronomy 6.9% (187 documents), Earth and Planetary Science 6.4% (73 documents), Arts and Humanities 3.9% (107 documents), Chemical Engineering 3.3% (91 documents), and 20% divided into several other subject areas, including Energy 90 documents, Mathematics 85 documents, Economics, Econometrics and Finance 78 documents , Agriculture and Biological Science 60 documents, Decision Science 58 documents, Chemistry 46 documents, Medicine 40 documents, Biochemistry, Genetics and Molecular Biology 29 documents, Multidisciplinary 21 documents, Pharmacology, Toxicology and Pharmaceutics 16 documents, Immunology and Microbiology 6 documents, Psychology 6 documents, Nursing 5 documents, Health Professions 4 documents, Veterinary 1 document.

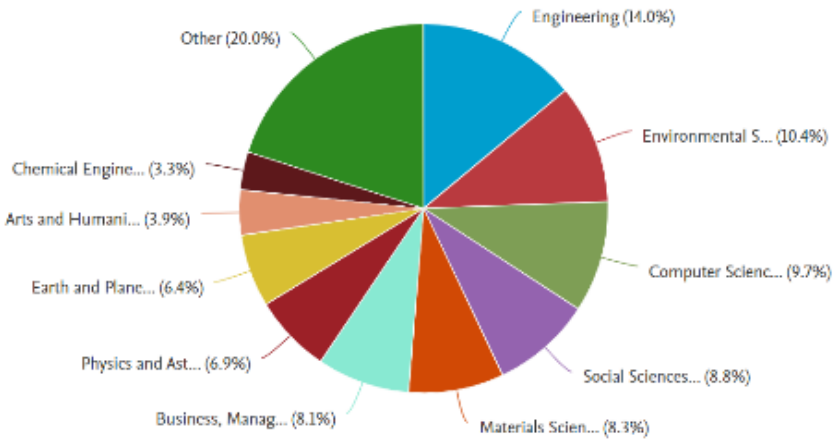


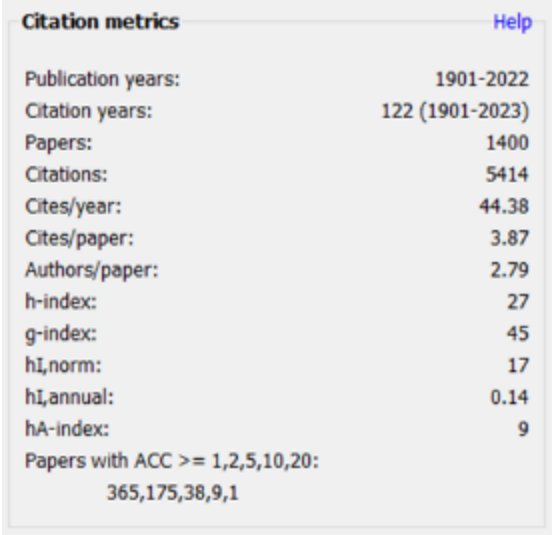
Figure 8. Subject area

Citation Analysis

Citations are used in scientific work to acknowledge the impact of previous work. The scientific impact assessment of a journal is calculated by dividing the number of citations by the number of articles published in a given time period, usually within two years of publication. The success of scientific work can be seen from the number or absence of other authors who cite the writing. The greater the number of citations, the greater the usefulness of the published work (Gunawan, 2020). Measuring the frequency of someone's scientific work being cited by others can be done through citation analysis (Erwina & Sodikin, 2018).

Citation analysis of publications that discuss batik can be done using the Publish or Perish application. Information in Figure 2 shows the citation metrics produced by publications related to batik. The results of the citation analysis on this metric are processed data taken from the Scopus database and displayed in metric form. Information on the metrics, namely: publication years, is information on the year the publication was published, namely 1901-2022. The number 122 in citation years is obtained from the results of citations or citations made by other authors from 1901 to 2023. The number of papers on batik produced in 1901-2022 was 1400 documents published and indexed in the Scopus database, with a total of 5414 citations. The cites/year figure shows the annual citation rate for publications related to batik, which is 44.38. The cites/paper number shows the citation rate per article/document in a publication about batik, namely 3.87, which is obtained from the total citation number (5414) divided by the number of articles (1400). The author/paper number shows the number of authors per article/document, which is 2.79.

The h-index number is 27, and the h-index is an index used to measure the productivity and impact of an article published by the authors. This index is based on the number of scientific works produced by the author and the number of citations received from other authors or publications (Aulianto & Nashihuddin, 2020). A journal can have an h-index if each article published is h and has been cited at least h times. The h-index reflects the number of publications and the number of citations per publication. The number of citations from the cumulative articles cited has an effect on other articles and can be used to calculate the g-index. The g-index calculation is the average number quoted as a whole after sorting it up to the number g. The weight of the quotation received by the document is considered in calculating the g-index, and the g-index for a particular author is not limited by the total number of publications (Costas & Bordons, 2008).



Citation metrics	Help
Publication years:	1901-2022
Citation years:	122 (1901-2023)
Papers:	1400
Citations:	5414
Cites/year:	44.38
Cites/paper:	3.87
Authors/paper:	2.79
h-index:	27
g-index:	45
hI,norm:	17
hI,annual:	0.14
hA-index:	9
Papers with ACC >= 1,2,5,10,20:	365,175,38,9,1

Figure 9. Publication citation metrics

H-index and g-index are numbers in the order of documents after the documents are sorted by the number of quotes. On the Harzing.com page, it is informed that hI, the norm is an individual h-index obtained from normalizing the number of citations for each article by dividing the number of citations by the number of authors for that article and then calculating the h-index of the normalized number of citations. hI-annual (HLA) is a number obtained from the hl-norm divided by academic age (the number of years valid since the first publication), and hA-index is a new revolutionary index for measuring the impact of a researcher, which is the average h-index. In Figure 2, publications about batik have an h-index of 27, g-index of 45, hI-norm of 17, hl-annual of 0.14 and hA-Index of 9.

The citation numbers obtained can be used to see the impact of a publication on contributions in the field being studied. The more often it is quoted, the greater the citation rate, which means that more and more writers use their writing as a reference in writing. The citation number shows how much the writer's contribution is to the academic world and the scientific fields they have. The results of data processing regarding the citation rate for each publication about batik can be seen in Table 2. The ranking is done to make it easier to see which publications have had an impact and is often used as references in research on batik.

Table 2. Publications about Batik with high citations (Top 10)

Authors	Title	Year	Cites
Syakur M.A.; Khotimah B.K.; Rochman E.M.S.; Satoto B.D.	Integration K-Means Clustering Method and Elbow Method for Identification of the Best Customer Profile Cluster	2018	405
Brenner S.A.	The domestication of desire: Women, wealth, and modernity in Java	2012	211
Lundkvist Å.; Cheng Y.; Sjölander K.B.; Niklasson B.O.; Vaheri A.; Plyusnin A.	Cell culture adaptation of Puumala hantavirus changes the infectivity for its natural reservoir, Clethrionomys glareolus, and leads to accumulation of mutants with altered genomic RNA S segment	1997	101
Rashidi H.R.; Sulaiman N.M.N.; Hashim N.A.; Hassan C.R.C.; Ramli M.R.	Synthetic reactive dye wastewater treatment by using nano-membrane filtration	2015	87
Azhar R.; Tuwohingide D.; Kamudi D.; Sarimuddin; Suciati N.	Batik Image Classification Using SIFT Feature Extraction, Bag of Features and Support Vector Machine	2015	68
Yin S.; Jin Z.; Miyake T.	Wearable high-powered biofuel cells using enzyme/carbon nanotube composite fibers on textile cloth	2019	65
Saputra M.D.; Joyoatmojo S.; Wardani D.K.; Sangka K.B.	Developing critical-thinking skills through the collaboration of Jigsaw model with problem-based learning model	2019	50
Soesanti I.; Syahputra R.	Batik production process optimization using particle swarm optimization method	2016	49
Tangahu B.V.; Ningsih D.A.; Kurniawan S.B.; Imron M.F.	Study of BOD and COD removal in batik wastewater using Scirpus grossus and Iris pseudacorus with intermittent exposure system	2019	47
Birgani P.M.; Ranjbar N.; Abdullah R.C.; Wong K.T.; Lee G.; Ibrahim S.; Park C.; Yoon Y.; Jang M.	An efficient and economical treatment for batik textile wastewater containing high levels of silicate and organic pollutants using a sequential process of acidification, magnesium oxide, and palm shell-based activated carbon application	2016	39

The citation figures are citations of all articles published from 1901 to 2022 and citations by other authors from 1901 to 2023 (as of June 2023). Furthermore, table 1 provides information on the highest number of article citations, namely 405 citations with articles written by Syakur et al. in 2018. The second rank, with 211 citations, was written by Brenner. The third rank with 101 citations was written by Lundkvist et al. in an article published in 1997. The fourth rank and so on can be seen in Table 2. The citation numbers in ranks four to ten are in the range of 39-87 citation numbers.

Publication Trends Based on Keywords Emergence

Based on the data processing results on keywords using the VOSviewer thesaurus file, publications about batik from 1901 to 2022 encompass a total of 6,700 keywords. If a minimum limit of 15 occurrences of a keyword is determined, 52 keywords that meet the minimum limit are obtained.

Table 3 displays information that the keywords most frequently used in publications about batik are the keyword "batik" with 254 occurrences, followed by the keyword "Indonesia" with 92 appearances and the keyword "Wastewater Treatment" in third position with 65 appearances. Other keywords that are popularly used are "dyeing, dyes, Textile industry, Culture Heritages, Color, Textiles, Sustainable development."

Table 2. Keyword occurrence list

Keywords	Occurrences
Batik	254
Indonesia	92
Wastewater treatment	65
Dyeing	57
Dyes	53
Textile industry	53
Culture Heritages	46
Color	45
Textiles	44
Sustainable Development	43

Keywords and the linkages between keywords can group publication trends. Based on the data processing results using VOSviewer, publication trends can be visualized to describe clusters and items from related publications. The distribution of clusters and items in publications about batik from 1901 to 2022 with a minimum limit of 15 times keywords, there are 52 items divided into 6 clusters, can be seen in Table 3. These clusters show the set of items included in the network map where one item can only be part of one cluster.

Table 3. Keyword occurrence list

Cluster 1 (Red)	Cluster 2 (Green)	Cluster 3 (Blue)
adsorption	class of information	batik industry
article	cultural heritages	commerce
batik wastewater	extraction	competitive advantage
chemical oxygen demand	feature extraction	Indonesia
effluents	image classification	innovation
heavy metals	image processing	marketing
human	image retrieval	performance
textile industry	Inform. systems	rural areas
textiles	physics	small and medium enterprise
waste treatment	product design	smes
wastewater	students	sustainability
wastewater treatment	textures	sustainable development
water quality		

Cluster 4 (Yellow)	Cluster 5 (Purple)	Cluster 6 (Light Blue)
batik dyeing	batik	color
dyeing	design	natural dyes
dyes	exhibition	synthetic dyes
fabrics	motif	
printing	textile art	
resist printing		
waxes		

Domination of the red color cluster of "wastewater treatment" with 32 links, a total link strength of 169 and occurrence of 65 times. The dominance of the green color cluster on "cultural heritages" with 30 links, a total link strength of 78 and an occurrence of 46 times. The dominance of the blue cluster on "Indonesia" with 44 links, a total link strength of 143 and an occurrence of 92 times. The dominance of the yellow cluster of "dyeing" with 29 links, a total link strength of 151 and an occurrence of 57 times. The dominance of the purple cluster on "Batik" with 42 links, a total link strength of 297 and an occurrence of 254 times. The dominance of the Tosca blue cluster on "Color" with 30 links, a total link strength of 105 and an occurrence of 45 times. "Links" shows the relationship/connection between two items, and "total link strength" shows the link strength of an item to other items. "Occurrence" indicates the presence or number of occurrences of the item. Visualization of six publication clusters about batik based on the appearance of keywords can be seen in Figure 10.

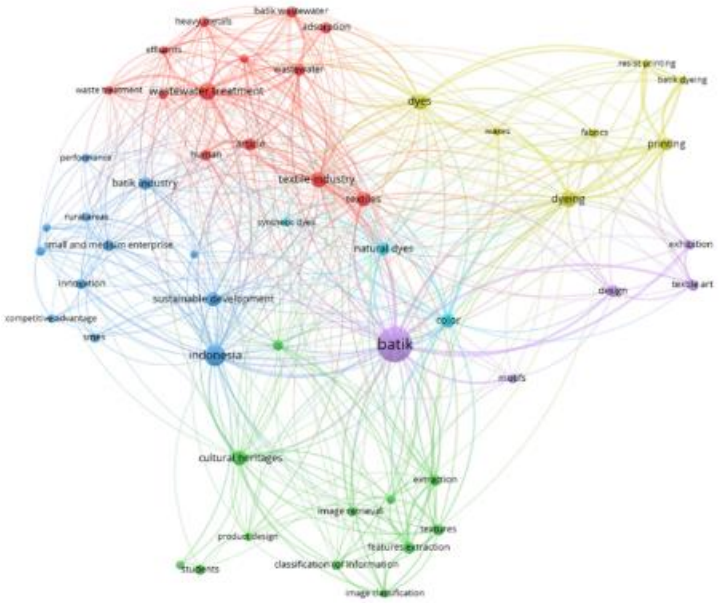


Figure 10. Visualization of publication trends based on keyword emergence

Publication Trends by Year of Publication

Visualization of publication trends by year shows the latest developments on batik topics (see Figure 11). The more yellow circles indicate the current time, and the darker blue circles indicate past research trends. In 2005 and the previous year, the trend of publications about famous batik related to batik techniques such as dyeing and printing batik. Other things discussed were dyeing batik, waxes, textile art, exhibitions, and fabrics.

The trends in notable publications around 2020 are visually represented by the greenish-yellow circle, highlighting discussions on the environmental effects of *batiks.* This encompasses topics such as wastewater treatment, effluents, heavy metals, and batik wastewater. Recent trends in *batik*-related publications have discerned a focus on subjects like small and medium enterprises, rural areas, competitive advantage, and product design. These emerging themes

signify a shift in research interests and reflect the evolving priorities within the field of *batik* studies, emphasizing both environmental concerns and socioeconomic aspects.

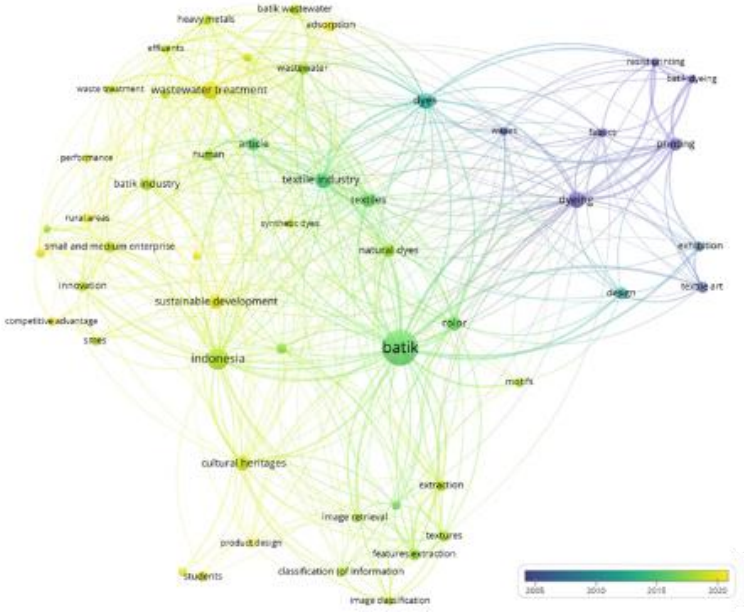


Figure 11. Visualization of publication trends by year of publication

4. CONCLUSION

The pinnacle of growth in scientific publications related to *batik*, as indexed in Scopus, occurred in the year 2020, reaching a zenith with a total of 215 documents. This surge in publications during 2020 underscores a heightened scholarly interest and engagement with the subject of batik, reflecting a period of significant academic output and research contributions to the field. The most prolific *batik* author is Widiaty, with 16 documents. Indonesia emerges as the predominant contributor in publications about batik, boasting a total of 925 documents. Within this landscape, Diponegoro University stands out as the institution with the most substantial affiliations, contributing 97 documents. This signifies Indonesia's central role in the scholarly discourse on batik, with Diponegoro University making a noteworthy impact through its substantial research output in this field.

Document type in the form of scientific articles is the largest, with 731 articles (52.2%). The most number of documents with the type of access "All Open Access" with a percentage of 45% are 66 documents. The subject area that most frequently discusses the topic of Batik is the Engineer field by 14% (381 documents). The cites/year figure shows the annual citation rate for publications related to Batik, which is 44.38. The cites/paper number shows the citation rate per article/document in a publication about Batik, namely 3.87, which is obtained from the total citation number (5414) divided by the number of articles (1400). The author/paper number shows the number of authors per article/document, which is 2.79. The highest number of article citations is 405 citations, with articles written by Syakur et al. in 2018, with the title 'Integration K-Means Clustering Method and Elbow Method for Identification of the Best Customer Profile Cluster'. Apart from that, the h-index is 27, the g-index is 45, the hI, norm is 17, HLA is 0.14, and hA-index is 9.

Mapping research on batik can provide broader recognition of Indonesia's cultural richness not only at the national level but also at the international level. It can help strengthen efforts to preserve and protect batik as an essential part of Indonesia's cultural identity.

Furthermore, mapping research on batik can help identify trends and research directions related to batik. In addition, this research can contribute to advancing knowledge about batik because understanding previous research helps researchers avoid duplication, identify research gaps that need to be explored and build new studies based on existing findings.

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