Bibliometric Analysis of Research Regarding Citarum River in Indonesia and Its Implication for Government Policy

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ABSTRACT

Research mapping related to river revitalization has been carried out on areas experiencing severe pollution to provide a roadmap for knowledge and answers to a number of environmental issues surrounding rivers. Therefore, this study aims to map a number of research publications regarding the Citarum River, which is an important area for people in West Java. This river is currently the most polluted in Indonesia, which led to the implementation of the revitalization program initiated by the government known as "*Citarum Harum*". The bibliometric method was used in this research to determine annual trends, keywords, field grouping, and location. The results showed a fluctuating increase in the number of research publications on the Citarum River. Furthermore, the mapping results showed that topics, study groups, and locations related to this river were unevenly distributed. These findings indicated the need for coordination from the "*Citarum Harum*" program coordinator or government to develop a research roadmap and direct the researcher to examine topics and raise issues related to locations that are yet to be studied.

INTRODUCTION

Rivers are natural potentials designed to improve human welfare. It serves as a water reservoir during the dry season, prevents floods by draining the water from upstream to downstream, acts as the center of an ecosystem rich in biological and mineral resources, and is used as a means of transportation, irrigation, recreational vehicles for nature tourism, and energy sources for power plants.

There are 333 rivers in Indonesia, with 29 in West Java Province. One of the largest rivers in this province is Citarum, which spans approximately 297 km and crosses 13 districts and cities. Furthermore, this river has provided enormous benefits to the surrounding community, but it has been deplorable over time. It is due to the

indiscriminate disposal of waste by households and industries, making it the most polluted in Indonesia and the world (Carrubba, 2020).

Various efforts have been made to overcome the indiscriminate disposal of mineral resources in Citarum, which led to the "*Citarum Harum*" program launched in 2018. Therefore, the government, academics, industries, media, and the public are mandated to participate in these activities based on their respective roles and capacities to solve these pollution problems by 2023.

Several preliminary studies have been carried out on the Citarum River by academics, and several various fields of science have been produced and published. This is expected to provide knowledge and recommendations for stakeholders to effectively and efficiently deal with these issues. However, some research topics and locations are not evenly distributed, accumulating in certain fields and locations. Therefore, this research is related to renewable energy, especially solar power, compared to other topics, such as water quality (Chazanah et al., 2020; Pratama et al., 2019; Ramadhiani & Suharyanto, 2021). The search results for article publications in indexing machine databases like Google Scholar showed that energy/solar power utilization topics are still limited.

As a tropical country, Indonesia has a relatively optimal availability of solar energy. Therefore, its adoption in eradicating this problem is also expected to be quite effective, supposing it is associated with the 13 action plans proclaimed in the *Citarum Harum* program. These include handling critical land, industries, livestock, domestic waste and its management, water resources, structuring net cages floating, law enforcement, education, public relations, monitoring river water quality, and tourism.

Based on these classifications, the energy and solar power research offers specific knowledge expected to resolve the Citarum River problem. For instance, recent international publications on the use of rivers and energy, especially for waste management, such as Solar Photovoltaic Power for Thermal Pyrolysis of Plastic Waste (Ghenai et al., 2020), Utilization of Solar Photovoltaic to Remove Antibiotics and Nitrogen from Wastewater (Li et al., 2020), Eco-energetics of Photovoltaic Systems in Wastewater Treatment (Bey et al., 2021), and Solar Photolytic Ozone to Remove Herbicides in River Water (Solís et al., 2019) were carried out on resolve the Citarum River problem. Therefore, more studies need to determine the problem-solving techniques and optimization of the Citarum River.

Inequality was discovered in the distribution of the research location, which was usually carried out upstream (Mudjiardjo et al., 2021; Ningrum et al., 2017; Sunardi et al., 2012). In fact, problems with river pollution are common in the downstream areas. To date, the Citarum River's benefits have not been felt by all those residing along the watershed. Therefore, only a few regions enjoy its resources; meanwhile, air, water, and soil pollution tend to occur in certain areas. This gap leads to social jealousy and mutual responsibility thereby, urgent study is needed to map the preliminary research carried out on the Citarum River, including annual trends, language used, its composition related to the *Citarum Harum* program, keywords, and locations.

The result is expected to aid in analyzing opportunities emanating from certain topics that have never been investigated and also indicates unexplored locations, as well

as avoid piling up studies related to some fields. It is also recommended for stakeholders to solve problems and optimize the river potential for the benefit of the community, especially in determining the research roadmap, as well as the effectiveness and efficiency of resources to achieve the goals of the *Citarum Harum* program.

Research is an attempt to investigate something to draw conclusions, provide answers to certain questions, make recommendations, balance materials during decision-making, and plan tools for sustainable activities. During the research process, discoveries of existing knowledge are made. Naidoo (2011), stated that research is a systematic investigation of nature and the society to validate and refine existing information and generate new knowledge. Research refers to the scientific search for knowledge and information related to a particular topic (Patel & Patel, 2019). Therefore, the acquired information and knowledge is used to answer certain questions and solve problems.

Research consists of questions related to a particular topic with answers expected to follow the problem-solving process. According to Strydom (2013), these questions state the problem in a way that investigates and defines its nature and scope. Disman (2017), stated that a research provides answers to the proposed questions and display findings in the form of information related to identifying the factors causing the anticipated problem, as well as the necessary steps needed for its resolution.

One of the objects of this research is river. Some international studies have been carried out on various rivers in the world, which is also one of the objects of this research. They discussed water pollution of major transboundary rivers from Banat (Dunca, 2018), the water quality of the River in Malaysia (Al-badaii et al., 2013), rivers that have the potential to cause floods in Indonesia (Sholihah et al., 2020), Dutch river basin management (den Haan et al., 2019), EU water resource management (Conallin et al., 2010), land use of the Rur River, Germany (Adhikari, 2020).

Several studies were recently carried out on energy-related rivers, such as the use of photovoltaic in the treatment of electronic waste generated by solar PV panels (Gautam et al., 2021), agricultural, agro-industry and livestock biomass waste (Sagastume Gutiérrez et al., 2020), biorefinery and energy recovery systems from manure (Rhee et al., 2021), as well as solar dryers and sewage sludge dehumidification processes (Tuncer et al., 2020).

The most recent studies on the Citarum River are still related to pollution. Most of these topics were reviewed based on the search results obtained on July 12, 2021, using the "Citarum River" keyword. The Publish or Perish tool (PoP), was used to ascertain that 27 articles were published in 2021. However, some of them explored the strategies used by local communities to evaluate the environment experiencing degradation and its impact on lives. The dominance of certain research related to this river shows the need for considering the distribution of topics.

Topics related to mapping are related to evaluating academic results realized from the research carried out in certain fields. However, this is achieved using bibliometrics, a set of methods to measure and evaluate academic results. Meanwhile, science mapping aims to extract information and knowledge from certain locations (Parlina et al., 2020).

Several specific studies related to rivers have been mapped out by experts using certain methods, such as bibliometric analysis of water resource management (Troian &

Gomes, 2020), soil erosion (Bezak et al., 2021), river water quality assessment (Wang et al., 2016), applications of microbial degradation (Verasoundarapandian et al., 2021), and management of plastic waste (Sousa, 2021). Furthermore, numerous studies that map research results related to certain water bodies includes bibliometric analysis of the Ganga River (Husain et al., 2018), and that of water and sediment in the Changjiang river (Guo et al., 2021), including scientometrics of water on the Yangtze river (Chen et al., 2018).

Bibliometric analysis, also called scientometrics studies, is one approach adopted to reveal research trends. It typically uses tools to evaluate the quantity and quality of published materials to observe patterns in a specific location that help to make predictions and research growth in a particular domain, such as citations, authors' details, publication classification, and impact, including a country's productivity (Ahmi & Mohamad, 2019).

This research reported data findings from several preliminary studies such as the use of language (Guo et al., 2021; Husain et al., 2018), cluster and author keywords (Troian & Gomes, 2020), subject category (Chen et al., 2018), and location (Zhang et al., 2019). It also serves as a form of response and follow-up to some previous studies and is expected to contribute to scientific communication. Besides, the impact of a particular publication needs to be considered because it is valuable (Tarango & Machin-Mastromatteo, 2017). Therefore, this study is expected to use scientific communication to increase its impact on the academic community and the public.

METHOD

This study uses the Google Scholar database as a source of information. In Indonesia, the national journal accreditation system has a minimum indexation requirement owned by Garuda (Digital Reference Garba) and Google Scholar. Meanwhile, studies related to the Citarum River are mostly published in national journals. Google Scholar is the ideal selection for almost any field of study, including those that need a complete number of citations rather than an exhaustive list of sources (Martín-Martín et al., 2021).

Meanwhile, this research aims to discover data related to annual trends, articles classified in reputable indexing institutions, the language used, the study field that refers to the *Citarum Harum* program, keywords, and location. The Google Scholar database met the requirements. However, a crosscheck was also conducted on the Scopus database to compare the number of publications with a certain indexation level.

The data was collected using the Publish or Perish tools (PoP). Software is used to acquire all relevant information, such as paper title, author, year, and theme (Darmani et al., 2013). Input and visualization of data were carried out using Microsoft Excel and VOSviewer.

The inclusion criteria include studies i) reviewing the Citarum River ii) in articles, iii) written in Indonesian and English languages, and iv) published between 2018 to 2020. The duration was selected owing to the start of the *Citarum Harum* program launch. The data search was carried out from January to March 2021. Meanwhile, studies that did not fit into the earlier-mentioned criteria were excluded.

This study started by searching for article data through the Publish or Perish tool by determining the queries '*Sungai Citarum*' and 'Citarum River' in the title and keywords

section and its limitations and publication year within 2018-2020. The data was saved as RIS and then imported into Zotero. The database was further checked to avoid duplication and ensure completeness such as title, authors, publication year, and keywords, with a total of 306 article titles fulfilling those criteria.

Subsequent stage determined the category of the study field and location by categorizing it into five development priorities. This was proclaimed in the "*Citarum Harum*" program, while the other was based on the division of the City or Regency which is the research location. The data collection related to the publication year, language used, study field, and location were inputted and visualized through Microsoft Excel. In addition, the keywords were visualized using VosViewer. The final stage is data analysis used to draw conclusion.

RESULTS AND DISCUSSION

This section describes the trend of research publications related to the Citarum River from 2018 to 2020, the number of published articles yearly, the language used, keywords, study groups, and locations. Each item is equipped with results and discussion.

Annual Research Publication Trend

This study adopted bibliometric analysis, a method used in various fields to identify the evolution of a specific theme (Ahmad et al., 2020). The annual publication trends were acquired using a bibliometric study. The data collection and analysis based on the publication year shows trends that have continued to develop within a certain period (Geng et al., 2020). Previous research showed that the annual research trend of the Citarum River has continued to increase since 1996, especially since 2015 (Endyana et al., 2021). However, different trends are reported in this study, as shown in Figure 1.
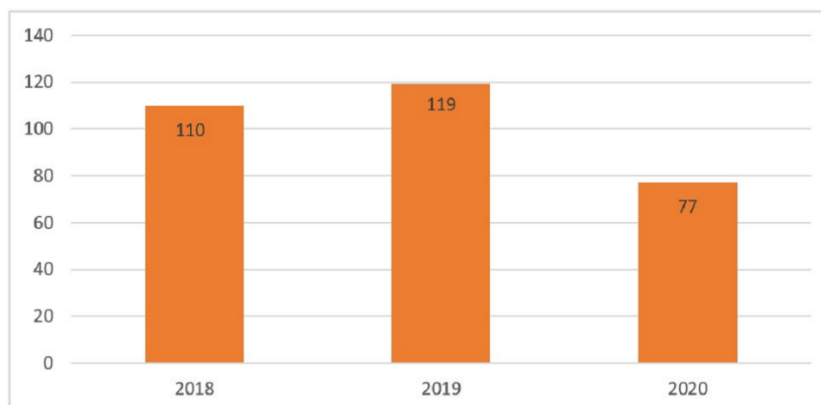

Figure 1. Trends in research publications related to the Citarum River from 2018 to 2020

Figure 1 shows an increasing number of publications, although some fluctuates were detected, such as trends on the Ganga River (Husain et al., 2018). This is slightly different from the research related to Yangze River where the number of publications increases annually (Chen et al., 2018). Concerning the Citarum River, an increase was detected in 2019 compared to 2018, however, there was a slight decrease again in 2020.

These studies are still at the output level and have not had a partial impact on society because, based on the news on www.kompas.id, the improvement of the Citarum

River in West Java in the third year of the 7-year plan for the *Citarum Harum* program is considered to be relatively 25%. However, in reality, the problem has been unresolved.

Furthermore, there was an increase in the number of research publications related to the Citarum River in the past three years. It is not known whether the results have been implemented or not, therefore, this needs to be ascertained by the *Citarum Harum* program coordinator. This is categorized as research that has a real impact on the revitalization of the Citarum River.

Trends in Research Publications related to the Citarum River based on Language

The use of language in publications plays an important role, while the studies published in other languages (non-English) have little or no effect (Fiala & Tutoky, 2017). Language barrier is a factor that affects the international visibility of non-English articles. Therefore, this research also presents data on trends and composition of language use in the publication of studies related to the Citarum River, as shown in Figure 2.

Figure 2 shows that the composition of research publications related to the Citarum River using Indonesian and English is 38:62, which is quite significant compared to similar studies. In the research carried out at Yangtze River, 99.04% was published in English (Chen et al., 2018), which is similar to the research related to Ganga River, whereby 99.6% were written in English (Husain et al., 2018).

The use of language in studies affects citations. Subsequently, those written in an international language such as English increase the chances of citation. Based on all the data processed in this research, in 2019 and 2020, the five studies ranked in the top position had the highest citation per year in the PoP calculation and were all written in English. Meanwhile 2018, four were written in English and the other in Indonesian.
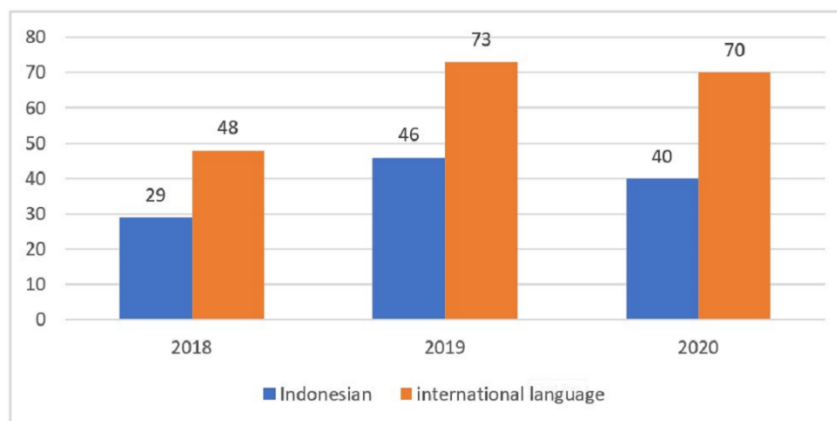

Figure 2. Trends in research publications related to the Citarum River from 2018 to 2020 based on the language used

The use of language by authors in writing articles, is a significant factor limiting the selection of international journals as potential publication media for research purposes (Horri, 2004). Many international organizations examined the Yangtze River's research, especially in water, due to its rapid economic development and environmental concerns (Chen et al., 2018). Meanwhile, publications on the Ganga River determined the number of internationally collaborative studies (Husain et al., 2018). These factors affect the language used, the number of citations, and the research institutions' reputations.

The research on the Ganga River has a high impact factor and many collaborative studies (Husain et al., 2018), as well as that carried out on the Yangze River (Chen et al., 2018). Therefore, research on the Citarum River is expected to increase the number of collaborative studies and the use of international languages in its publications. This is because the popularity of the published results attracts the attention of various regions and the greater the studies on the Citarum River the more the references cited to answer and accelerate the resolution of its problem.

Mapping the Citarum River Study Topic Based on Keywords

The most frequently applied keyword analysis reveals several focal points over a given period (Dehghanbanadaki et al., 2020). Those considered to represent the publication frame were created and its analysis in scientific studies is used to monitor and identify trends in various fields (Salmerón-Manzano & Manzano-Agugliaro, 2017). The results of the keyword mapping are shown in Figure 3.
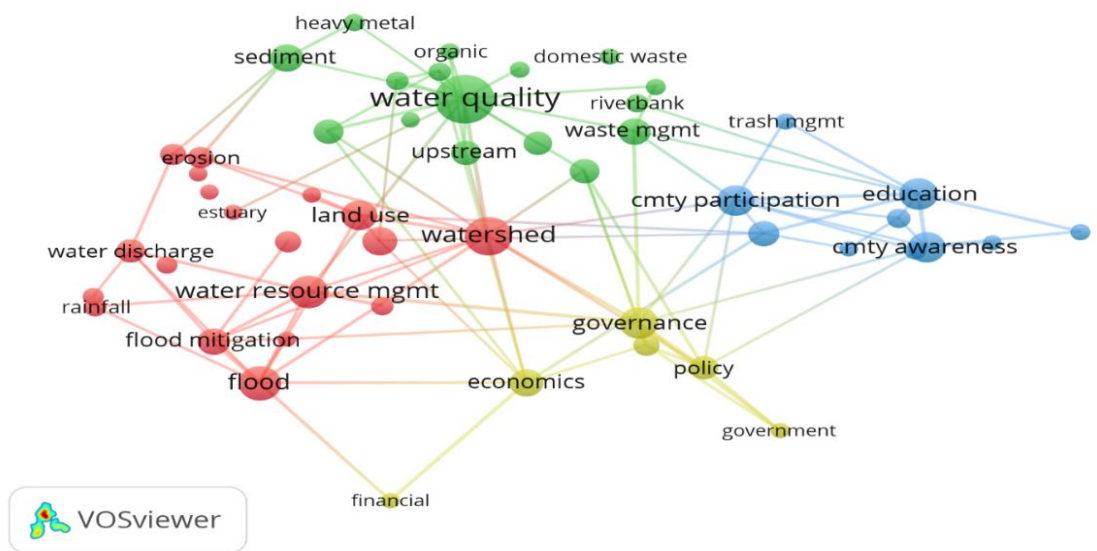

Figure 3. Mapping of research publications related to the Citarum River from 2018 to 2020 based on keywords

President Jokowi launched the Citarum Harum Program through Presidential Regulation Number 15 of 2018 concerning the Acceleration of Pollution Control and Damage to the Citarum River Basin. Since then, there have been calls for this initiative to receive full support from the government, academia, media, industries, and the community, thereby conveying their thoughts through scientific studies.

The results of the keyword mapping showed that there is a gap in the number of topics described. The most studied are water quality, watersheds, education, and governance. In fact, of the five priority programs, the 13 action plans launched in the *Citarum Harum* program consisting of aspects of handling critical land, industries, livestock, and domestic waste, and its management, water resources, structuring floating net cages, law enforcement, education, public relations, monitoring of river water quality, and tourism.

These findings differ from the research on the Ganga River in India. The keywords used include Groundwater, Climate change, Heavy metals, Water quality, Basin

Weathering, and Sediment (Husain et al., 2018). Few studies similar to this topic have been carried out on the Citarum River. It is therefore necessary to carry out further analyses in this field, to obtain results and recommendations for achieving the river revitalization program.

Mapping the Citarum River Research Topic based on the Study Field Group

A few studies have reported topic mapping using bibliometric analyses. Its division is based on the Web of Science (Husain et al., 2018), and ISI subject categories (Molatudi et al., 2009), as well as theoretical concepts (Bauman & Bachmann, 2017), and the field of science (Ahmi & Mohamad, 2019). Meanwhile, topics are categorized based on the study fields. This consists of five prioritized themes which sharpen the 13 action plans of the *Citarum Harum* program, including education, creative economy, conservation, pollution, and governance. The grouping of the study fields is shown in Figure 4.

The bibliometric analysis makes it easier to discover several interesting themes according to their scientific fields and identify the most popular ones and vice versa. Its strong visualization ability helps readers to easily and identify clusters of research interests in a particular field (Geng et al., 2020).
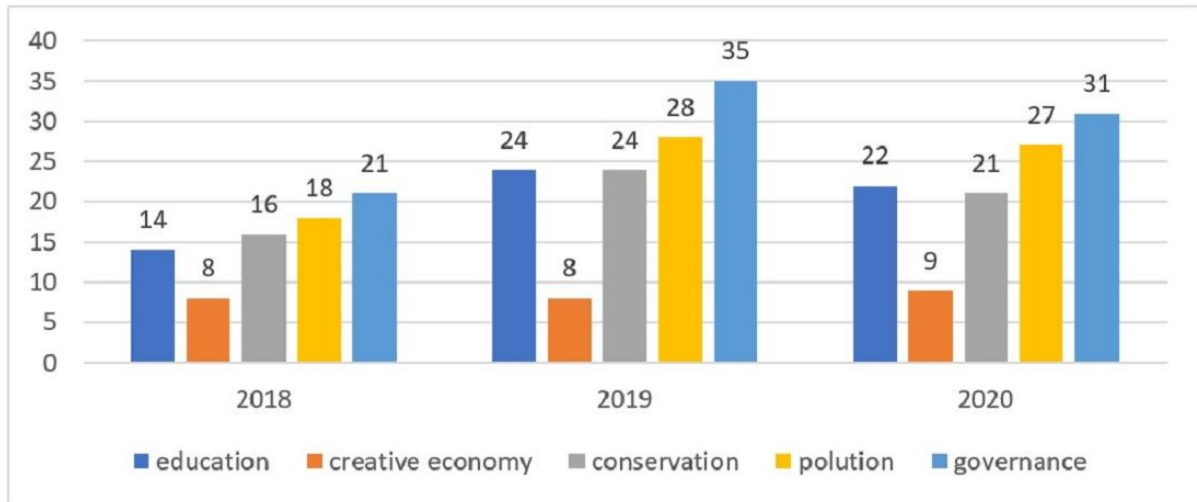

Figure 4. Trends in research publications related to the Citarum River from 2018 to 2020 based on the study fields groups
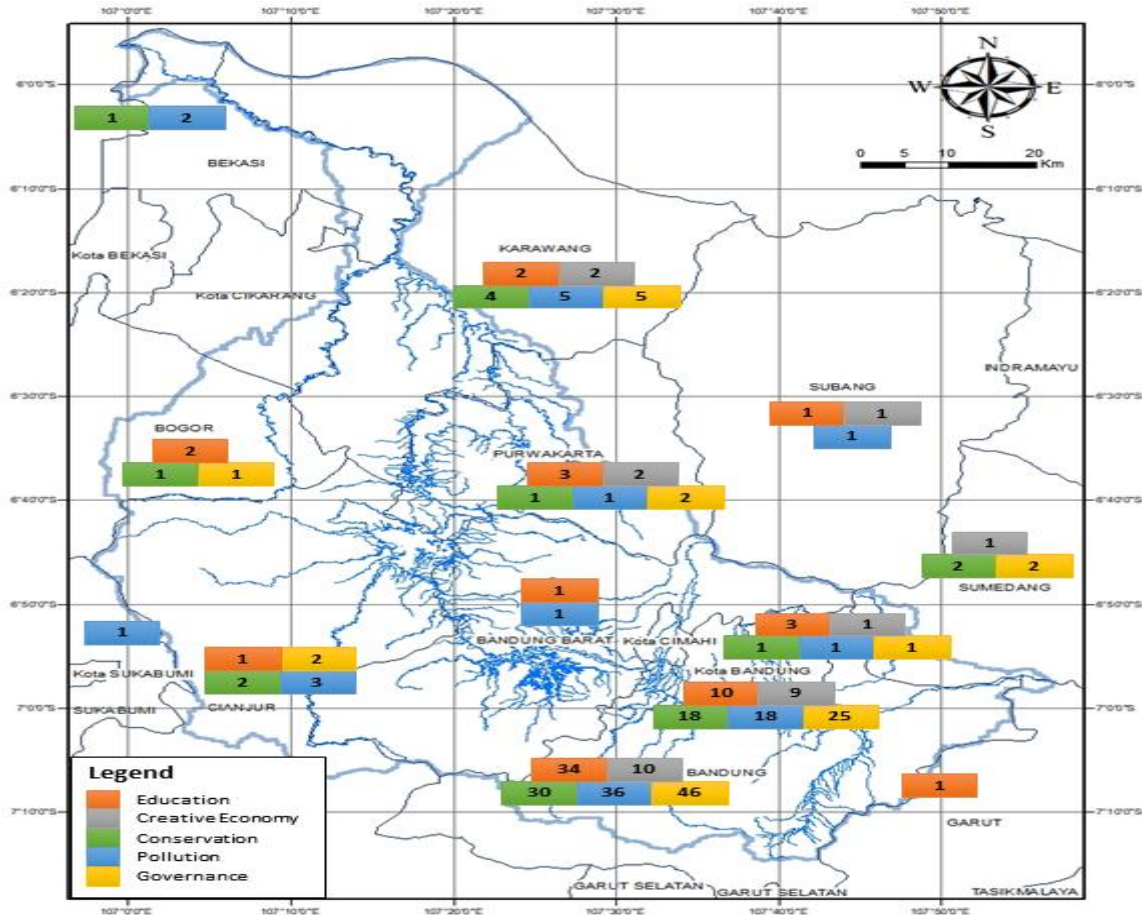
Figure 5. Mapping of research publications related to the Citarum River from 2018 to 2020 based on the study field and locations

Figure 4 shows that every year, the number of topics related to Citarum in the governance field group is always greater than the other four, while the creative economy category is always less. Several factors cause the high number in the governance field group, because water is an important part of the developmental process involving the intersecting interests of various public stakeholders (Tortajada, 2010). The involvement of various aspects and stakeholders in water, particularly river management, comprises many topics that need to be examined.

The limited number in the creative economy group is due to the fact that they are mostly written in the form of reports rather than article publications. The search results related to the keyword Citarum River generated with the Publish or Perish tool 2018 were also used to obtain 115 titles with only 77 detected as published articles. This means that 33% were not published in journals or proceedings, which led to the poor readability of the research by the academic community and other interested parties.

Mapping of Citarum River Research Topics based on the Field of Study and Location

Bibliometric studies tend to map locations based on the author's origin, such as country (Aria & Cuccurullo, 2017; Shareefa & Moosa, 2020), institution (Salmerón-Manzano & Manzano-Agugliaro, 2017), and where the publications or conferences were held (Fiala & Tutoky, 2017). However, in this study, it is based on the scope of the

research location. Alongside its flow, the Citarum River passes through 13 regencies and cities in West Java. This includes Bandung, West Bandung, Bekasi, Cianjur, Bogor, Indramayu, Karawang, Purwakarta, Subang, and Sumedang Regencies, as well as Bandung, Bekasi and Cimahi City.

The results obtained from examining 306 studies on the Citarum River proved that 14 cities and regencies were used as the research location. This data shows that it is not always acquired in the city or regency where the river flow directly passes. The mapping of the research publications from 2018 to 2020 based on the study field and location is shown in Figure 5.

Several studies related to the Citarum River have been performed in a number of cities or regencies. Majority were carried out in Bandung Regency, and City, including Karawang. Meanwhile, 156 out of the 306 studies, were carried out in Bandung Regency (51%) and as many as 46 were categorized in the Governance group.

Based on the aspect of topic distribution and location, these findings indicate an uneven composition of the research publications. In terms of the location, most were carried out in the upstream area of the river. This is consistent with similar research which stated that study sites are not evenly distributed, and are only concentrated in a few areas (Zhang et al., 2019). This is caused by factors such as location affordability and the actuality of problems in a particular place. As a result, easily accessed locations with generally known issues are usually selected.

CONCLUSION

In conclusion, despite the increase in the number of research publications related to the Citarum River, there are still certain fluctuations because some are yet to be published. It leads to poor readability by the academic community and other interested parties. The composition of research publications related to the Citarum River in English is more than those written in Indonesian. However, this refers to publications in the form of journals or proceedings. Meanwhile, those in the form of reports were written in Indonesian.

There is also a gap in the number of topics depicted in the keywords of the research publication. The most are those related to water quality, watersheds, education, and governance. Therefore, this study suggests that various fields need to be analyzed with the roadmap supporting river revitalization. Every year, the number of topics related to Citarum River in the governance field group is always more significant than the other four topics. At the same time, the creative economy is usually less. Furthermore, in terms of locations, most studies are carried out in cities traversed by the river, usually upstream. Therefore, the Citarum Harum program coordinators have to collaborate with academics to ascertain topics and locations that need to be explored.

The main limitation of this bibliometric study is related to the sensibility of the criteria and filters used to collect the sample. Depending on the search query operator, the process hid some relevant publications. However, its limitation makes it easier to select relevant data. The publication type was only limited to journals and proceedings. This shows that research publications on the Citarum River are not optimal because some are still stored as reports. Furthermore, certain limitations were also encountered in classifying research locations, considering that some articles tend not to state these issues accurately.

REFERENCES

Adhikari, S. (2020). Temporal Dynamics of Land Use and Water Quality in Three Sub-Catchments of the Rur River, Germany. *Journal of Geoscience and Environment Protection*, *08*, 36–47. https://doi.org/10.4236/gep.2020.88004

Ahmad, I., Ahmed, G., Shah, S. A. A., & Ahmed, E. (2020). A decade of big data literature: analysis of trends in light of bibliometrics. *Journal of Supercomputing*, *76*(5), 3555–3571. https://doi.org/10.1007/s11227-018-2714-x

Ahmi, A., & Mohamad, R. (2019). Bibliometric Analysis of Global Scientific Literature on Web Accessibility. *International Journal of Recent Technology and Engineering (IJRTE)*, *7*(6S2). https://doi.org/10.1101/2020.03.19.20038752

Al-badaii, F., Shuhaimi-othman, M., & Gasim, M. B. (2013). Water Quality Assessment of the Semenyih River ,. *Journal of Chemistry*, *2013*(Article ID 871056), 112–122. https://doi.org/http://dx.doi.org/10.1155/2013/871056

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Bauman, A., & Bachmann, R. (2017). Online consumer trust: Trends in research. *Journal of Technology Management and Innovation*, *12*(2), 68–79. https://doi.org/10.4067/S0718-27242017000200008

Bey, M., Hamidat, A., & Nacer, T. (2021). Eco-energetic feasibility study of using grid-connected photovoltaic system in wastewater treatment plant. *Energy*, *216*, 119217. https://doi.org/10.1016/j.energy.2020.119217

Bezak, N., Mikoš, M., Borrelli, P., Alewell, C., Alvarez, P., Anache, J. A. A., Baartman, J., Ballabio, C., Biddoccu, M., Cerdà, A., Chalise, D., Chen, S., Chen, W., De Girolamo, A. M., Gessesse, G. D., Deumlich, D., Diodato, N., Efthimiou, N., Erpul, G., … Panagos, P. (2021). Soil erosion modelling: A bibliometric analysis. *Environmental Research*, *197*(March). https://doi.org/10.1016/j.envres.2021.111087

Carrubba, A. (2020). *Rotten river: life on one of the world's most polluted waterways – photo essay*. The Guardian.

Chazanah, N., Muntalif, B. S., Rahmayani, R. A., & Sudjono, P. (2020). Macrozoobentos distribution as a bioindicator of water quality in the upstream of the citarum river. *Journal of Ecological Engineering*, *21*(3), 10–17. https://doi.org/10.12911/22998993/116335

Chen, D., Bi, B., Luo, Z. H., Yang, Y. W., Webber, M., & Finlayson, B. (2018). A scientometric review of water research on the Yangtze river. *Applied Ecology and Environmental Research*, *16*(6), 7969–7987. https://doi.org/10.15666/aeer/1606_79697987

Conallin, J., Boegh, E., & Jensen, J. K. (2010). Instream physical habitat modelling types: An analysis as stream hydromorphological modelling tools for EU water resource managers. *International Journal of River Basin Management*, *8*(1), 93–107. https://doi.org/10.1080/15715121003715123

Darmani, A., Ramirez-Portilla, A., & Dwaikat, N. (2013). 12 Years of Scholary Research: Content and Trend Analysis of the Journal Creativity and Innovation Management. *The 22nd International Conference on Management of Technology – IAMOT*, 17.

Dehghanbanadaki, H., Seif, F., Vahidi, Y., Razi, F., Hashemi, E., Khoshmirsafa, M., & Aazami, H. (2020). Bibliometric analysis of global scientific research on Coronavirus (COVID-

19). *Medical Journal of the Islamic Republic of Iran*, *34.51*. https://doi.org/10.34171/mjiri.34.51

den Haan, R. J., Fliervoet, J. M., van der Voort, M. C., Cortes Arevalo, V. J., & Hulscher, S. J. M. H. (2019). Understanding actor perspectives regarding challenges for integrated river basin management. *International Journal of River Basin Management*, *17*(2), 229–242. https://doi.org/10.1080/15715124.2018.1503186

Disman, D., Ali, M., & Syaom Barliana, M. (2017). The Use of Quantitative Research Method and Statistical Data Analysis in Dissertation: an Evaluation Study. *International Journal of Education*, *10*(1), 46–52. https://doi.org/10.17509/ije.v10i1.5566

Dunca, A. M. (2018). Water pollution and water quality assessment of major transboundary rivers from Banat (Romania). *Journal of Chemistry*, *2018*(Article ID 9073763,). https://doi.org/10.1155/2018/9073763

Endyana, C., Hafiar, H., & Mahameruaji, J. N. (2021). The Information Analysis And The Review Of Research Results As A Source Of Knowledge For The Mapping Of Advanced Research (Bibliometric analysis of the research on The Citarum River). *Library Philosophy and Practice (e-Journal)*, *2021*, 1–10.

Fiala, D., & Tutoky, G. (2017). Computer science papers in web of science: A bibliometric analysis. *Publications*, *5*(4), 1–16. https://doi.org/10.3390/publications5040023

Gautam, A., Shankar, R., & Vrat, P. (2021). End-of-life solar photovoltaic e-waste assessment in India: a step towards a circular economy. *Sustainable Production and Consumption*, *26*, 65–77. https://doi.org/10.1016/j.spc.2020.09.011

Geng, D., Feng, Y., & Zhu, Q. (2020). Sustainable design for users: a literature review and bibliometric analysis. *Environmental Science and Pollution Research*, *27*(24), 29824–29836. https://doi.org/10.1007/s11356-020-09283-1

Ghenai, C., Rasheed, M. A., Alshamsi, M. J., Alkamali, M. A., Ahmadb, F. F., & Inayat, A. (2020). Design of Hybrid Solar Photovoltaics/Shrouded Wind Turbine Power System for Thermal Pyrolysis of Plastic Waste. *Case Studies in Thermal Engineering*, *22*(100773). https://doi.org/https://doi.org/10.1016/j.csite.2020.100773

Guo, Z., Wang, D., Zhang, L., Huang, H., & Wang, D. (2021). Bibliometric Analysis of Research on the Water and Sediment Environment in the Middle Lower Changjiang River Basin. *IOP Conference Series: Earth and Environmental Science*, *668*(1), 0–10. https://doi.org/10.1088/1755-1315/668/1/012047

Horri, A. (2004). Bibliometric Overview of Library and Information Science Research Productivity in Iran. *Journal of Education for Library and Information Science*, *45*(1), 15. https://doi.org/10.2307/40323918

Husain, S., Raza, A., & Gul, R. (2018). Literature on River Ganga : A Bibliometric Analysis. *Journal of Indian Library Association*, *54*(1), 1-10. https://www.ilaindia.net/jila/index.php/jila/article/view/233

Li, N., Zhang, X., Zhao, M., Zhang, Y., Yuan, Y., Lu, X., Zhang, H., & Sun, J. (2020). Integrating solar photovoltaic capacitor into algal-bacterial photo-bioelectrochemical system towards all-weather synchronous enhanced antibiotic and nitrogen removal from wastewater. *Journal of Cleaner Production*, *272*, 122661. https://doi.org/10.1016/j.jclepro.2020.122661

Martín-Martín, A., Thelwall, M., Orduna-Malea, E., López-Cózar, E. D., & Delgado López-Cózar, E. (2021). Google scholar, microsoft academic, scopus, dimensions, web of

science, and opencitations' COCI: A multidisciplinary comparison of coverage via citations. *Scientometrics*, *126*(1), 871–906. https://doi.org/10.1007/s11192-020-03690-4

Molatudi, M., Molotja, N., & Pouris, A. (2009). A bibliometric study of bioinformatics research in South Africa. *Scientometrics*, *81*(1), 47–59. https://doi.org/10.1007/s11192-007-2048-6

Mudjiardjo, A. S. U., Moersidik, S. S., & Darmajanti, L. (2021). Analysis of water pollution using the STORET method in the Upper Citarum Watershed. In H. H. (Ed.), *1st Journal of Environmental Science and Sustainable Development Symposium, JESSD 2020* (Vol. 716, Issue 1). IOP Publishing Ltd. https://doi.org/10.1088/1755-1315/716/1/012012

Naidoo, N. (2011). What is research? A conceptual understanding. *African Journal of Emergency Medicine*, *1*, 47–48. https://doi.org/10.1016/j.afjem.2011.05.011

Ningrum, W. S., Widyaningsih, Y., & Indra, T. L. (2017). Spatial modeling on the upperstream of the Citarum watershed: An application of geoinformatics. In A. Y., S. Y., & S. J. (Eds.), *2nd International Conference on Applied Statistics: Statistics and Its Applications, ICAS 2016* (Vol. 1827). American Institute of Physics Inc. https://doi.org/10.1063/1.4979433

Parlina, A., Ramli, K., & Murfi, H. (2020). Theme mapping and bibliometrics analysis of one decade of big data research in the scopus database. *Information (Switzerland)*, *11*(2), 1–26. https://doi.org/10.3390/info11020069

Patel, M., & Patel, N. (2019). Exploring Research Methodology : Review Article. *International Journal of Research and Review*, *6*(3), 48–55.

Pratama, R. P., Rusdinar, A., & Wibawa, I. P. D. (2019). Floating robot control system for monitoring water quality levels in citarum river. *2019 IEEE International Conference on Internet of Things and Intelligence System, IoTaIS 2019*, 206–211. https://doi.org/10.1109/IoTaIS47347.2019.8980393

Ramadhiani, A. F., & Suharyanto. (2021). Analysis of river water quality and pollution control strategies in the upper Citarum River. *2nd International Conference on Environment, Sustainability Issues, and Community Development, INCRID 2020*, *623*(1). https://doi.org/10.1088/1755-1315/623/1/012052

Rhee, G., Lim, J. Y., Hwangbo, S., & Yoo, C. K. (2021). Evaluation of an integrated microalgae-based biorefinery process and energy-recovery system from livestock manure using a superstructure model. *Journal of Cleaner Production*, *293*(xxxx), 125325. https://doi.org/10.1016/j.jclepro.2020.125325

Sagastume Gutiérrez, A., Cabello Eras, J. J., Hens, L., & Vandecasteele, C. (2020). The energy potential of agriculture, agroindustrial, livestock, and slaughterhouse biomass wastes through direct combustion and anaerobic digestion. The case of Colombia. *Journal of Cleaner Production*, *269*, 122317. https://doi.org/10.1016/j.jclepro.2020.122317

Salmerón-Manzano, E., & Manzano-Agugliaro, F. (2017). Worldwide scientific production indexed by Scopus on labour relations. *Publications*, *5*(25). https://doi.org/10.3390/publications5040025

Shareefa, M., & Moosa, V. (2020). The Most-cited Educational Research Publications on Differentiated Instruction: A bibliometric analysis. *European Journal of Educational*

Research, *9*(1), 331–349. https://doi.org/10.12973/eu-jer.9.1.331

Sholihah, Q., Kuncoro, W., Wahyuni, S., Puni Suwandi, S., & Dwi Feditasari, E. (2020). The analysis of the causes of flood disasters and their impacts in the perspective of environmental law. *IOP Conference Series: Earth and Environmental Science*, *437*(012056), 1–7. https://doi.org/10.1088/1755-1315/437/1/012056

Solís, R. R., Medina, S., Gimeno, O., & Beltrán, F. J. (2019). Solar photolytic ozonation for the removal of recalcitrant herbicides in river water. *Separation and Purification Technology*, *212*, 280–288. https://doi.org/10.1016/j.seppur.2018.11.035

Sousa, F. D. B. de. (2021). Management of plastic waste: A bibliometric mapping and analysis. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, *39*(5), 664–678. https://doi.org/https://doi.org/10.1177/0734242X21992422

Strydom, H. (2013). An evaluation of the purposes of research in social work. *Social Work (South Africa)*, *49*(2), 149–164. https://doi.org/10.15270/49-2-58

Sunardi, Kaniawati, K., Husodo, T., Malini, D. M., & Astari, A. J. (2012). Distribution of Fish in the Upper Citarum River: an Adaptive Response to Physico-Chemical Properties. *HAYATI Journal of Biosciences*, *19*(4), 191–196. https://doi.org/10.4308/hjb.19.4.191

Tarango, J., & Machin-Mastromatteo, J. D. (2017). Conceptualization of Scientific Productivity, Production, Dissemination, and Communication. In *The Role of Information Professionals in the Knowledge Economy* (Issues 2 (27-70)). https://doi.org/10.1016/b978-0-12-811222-9.00002-9

Tortajada, C. (2010). Water governance: Some critical issues. *International Journal of Water Resources Development*, *26*(2), 297–307. https://doi.org/10.1080/07900621003683298

Troian, A., & Gomes, M. C. (2020). A bibliometric analysis on the use of the multicriteria approach to the water resource management. *Gestao e Producao*, *27*(2), 1–18. https://doi.org/10.1590/0104-530X4761-20

Tuncer, A. D., Sözen, A., Afshari, F., Khanlari, A., Şirin, C., & Gungor, A. (2020). Testing of a novel convex-type solar absorber drying chamber in dehumidification process of municipal sewage sludge. *Journal of Cleaner Production*, *272*, 122862. https://doi.org/10.1016/j.jclepro.2020.122862

Verasoundarapandian, G., Wong, C. Y., Shaharuddin, N. A., Gomez-Fuentes, C., Zulkharnain, A., & Ahmad, S. A. (2021). A review and bibliometric analysis on applications of microbial degradation of hydrocarbon contaminants in arctic marine environment at metagenomic and enzymatic levels. *International Journal of Environmental Research and Public Health*, *18*(4), 1–31. https://doi.org/10.3390/ijerph18041671

Wang, Y., Xiang, C., Zhao, P., Mao, G., & Du, H. (2016). A bibliometric analysis for the research on river water quality assessment and simulation during 2000–2014. *Scientometrics*, *108*(3), 1333–1346. https://doi.org/10.1007/s11192-016-2014-2

Zhang, X., Estoque, R. C., Xie, H., Murayama, Y., & Ranagalage, M. (2019). Bibliometric analysis of highly cited articles on ecosystem services. *PLoS ONE*, *14*(2), e0210707. https://doi.org/10.1371/journal.pone.0210707