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Mapping Visualization of Maritime Technology Study in Indonesia with Bibliometric Analysis Using VOSviewer

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ABSTRACT

Indonesia is a large country with many spreading archipelagos. The condition makes Indonesia a potential country in maritime sectors. The potential condition establish maritime technology is a topic that has begun to interest many researches. The strong desire of researcher will also get support from the many sources of citations that are now appearing and can be used as references. Even though it has a wide area of expertise, the researches concerning maritime technology is very little at present. This research aims to collect the trends of maritime technology research in Indonesia by performing bibliometric analysis from scientific papers indexed by partly free scholarly database named Dimension. This research analyzes the numbers of document published, the most cited papers, and the productivity of maritime researchers in specific area of maritime technology. Some keywords focused on this researched were minned by clustering using VOSviewer. As the result, this study hopefully provide an overview of current research on maritime technology in Indonesia and provide the right direction for researchers with maritime technology research interest.

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1. INTRODUCTION

Indonesia is a potential development for maritime sectors based on the large of its archipelagos country (see http://www.perumperindo.co.id/publikasi/artikel/21-potensi-indonesia-sebagai-negara-maritim). The existence of coastlines on almost every island in Indonesia (±54,720 km) which makes Indonesia rank third after Canada and Norway as a country that has the longest coastline in the world (Kumar 2019: List of Countries and Islands with Longest Coastline-NCERT Notes). Indonesia also conceive with 514 cities spread over thousands of islands and its population is measured to reach 318.9 million in 2045 (BPS Statistic). This strength has great potential to advance the Indonesian economy with the diversity of Indonesia's Maritime potential. It is recorded that Indonesian maritime research has been started since 1872 (Nontji 2017: Ekspedisi challenger (1872-1876). Peletak fondasi oseanografi modern). Meanwhile, marine research institutes have existed since 1905 under the name "Visscherij Laboratorium te Batavia" which is located in Sunda Kelapa, Jakarta. This institution later metamorphosed and became known as the LIPI Oceanographic Research Center (see https://www.kompas.com/sains/read/ 2020/08/29/173400523/riset-kelautan-di-indonesia-maju-tapi-tertinggal?page=all). Even though we already have special research institutes and maritime department at universities, research on maritime technology is still uncoordinated and results in undirected development in the maritime sector (see https://mediaindonesia.com/read/detail/80735-riset-maritim-kurang-diperhatikan).

There are many journal resource databases can be used nowadays. Some researchers usually use Scopus as their references for the research. Dimensions is a partly free scholarly database launched by Digital Science in January 2018 (Thelwall, 2018 , Falagas. et al. 2008). Dimensions includes journal articles and citation counts, making it a potential new source of impact data. This system used not only because of the huge amount of data it provides, including the number of citations per publication (Falagas et al., 2008), but also because it offers an API to perform queries using a specific DSL (Domain Specific Language) (García-Sánchez, 2019). **Figure 1** showed the increment of citation per year from Dimension. The keywords maritime technology and Indonesia used to extract chart data. During 2016 to 2021, there are 82 citations with 0.91% Mean value.

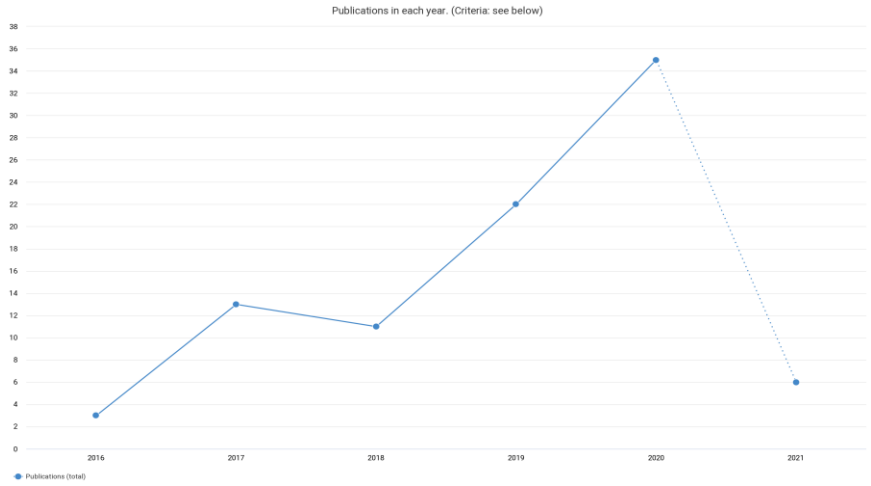

Figure 1. Average citation during 2016-2021 using keywords maritime technology and Indonesia.

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The main objective of this research is to present a knowledge map of maritime technology research in Indonesia. It is intended to inform researchers and decision makers to recognize knowledge areas, evaluate knowledge gaps and identify future development opportunities. This research is consisting of four sections. The first section is discussed about introduction as explained. The second section is talking about methods that used. The section IV is talking about result and discussion of this research and the last section is talking about conclusion.

2. METHODS

To avoid confusion in the use of the terms maritime and marine, this research uses a different approach in interpreting the two terms. Maritime and marine research has different drivers (Hildebrand, 2014) (see https://link.springer.com/article/10.1007/s13437-014-0072-y). The Maritime industry works to achieve sustainable and efficient operations, and to position the maritime industry to meet challenges, such as competitiveness and cost efficiency. Marine research, on the other hand, is driven by the need to understand ecosystems, how they function and how they change, and to understand the impact of human activities on ecosystems and to develop options for sustainable use. The challenge is to convene the two communities, to address issues such as the transfer of marine invasive species through maritime transport, or the impact of ships on marine mammals.

A European association of universities in marine technology, WEGEMT, stipulated the term technology for the safe use, exploitation, protection of, and intervention in, the marine environment (see http://www.wegemt.com/about/history). In this assume, according to WEGEMT, the technologies involved in marine technology are the following: naval architecture, marine engineering, ship design, ship building and ship operations; oil and gas exploration, exploitation, and production; hydrodynamics, navigation, sea surface and sub-surface support, underwater technology and engineering; marine resources (including both renewable and non-renewable marine resources); transport logistics and economics; inland, coastal, short sea and deep sea shipping; protection of the marine environment; leisure and safety (Hildebrand, 2014).

This bibliometric study uses quantitative study of spesific term in english language literature stored in the Dimension database containing the keyword “maritime technology” and “Indonesia” in their title, abstract or keyword. This research also left out the keyword “marine” and “marine technology” to give the scope of limitation as mentioned before. The collection of data collected were analyzed and visualized using VOSViewer (Nandiyanto, 2020; Nandiyanto, 2021; van Eck and Waltman, 2010).

3. RESULTS AND DISCUSSION

Bibliometrics is a relatively important subject or branch of information science (Abedin et al., 2021; Mathankar, 2019; Munim et al., 2020). It lies between the border areas of the social science and the physical science. Its scope, includes the studying the relationship within a literature (e.g., citation studied) or describing a literature (Donthu, et al., 2021; García-Sánchez. et al. 2019). Typically, these descriptions focus on consistent patterns involving authors, monographs, journals or subject/ language. Bibliometric analysis may be

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classified under two broad groups (van Eck and Waltman, 2010). One describing the characteristics of a literature (descriptive studies), and the other examining the relationships formed between components of a literature (behavioral studies) (Donthu et al., 2021). The literature description is mainly based on the following characteristics of documents.

Figure 2 explain comparison between Dimension and Scopus in another sample of research (Thelwall, 2018). The research stated that average (geometric mean) scores for Scopus Food Science articles 2008–2018 (February) as of February 2018. For each source, all articles without a score are excluded for the calculations. For Scopus, articles not found in Dimensions are excluded from the calculations. Error bars show 95% confidence intervals (Thelwall, 2018).

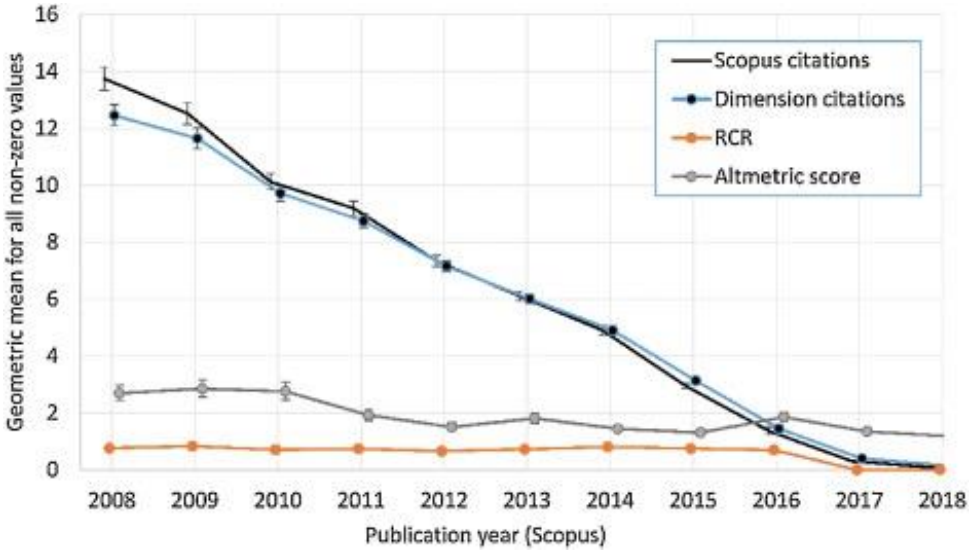

Figure 2. Average (geometric mean) scores for Scopus & Dimension (Thelwall, 2018).

Bibliometric research in the maritime field that touches on technological aspects in Indonesia has never been studied before. However, the LIPI Oceanographic Research Center for the period 2013 to 2017 has published 49 titles of articles related to marine research (Royani and Idhani, 2018). His research has also been carried out using the bibliometric analysis method. The research conducted does not provide much important information about technology mapping because it only classifies the distribution of the number of studies per year.

This section presents descriptive analysis of the retrieved data from Dimension. As mentioned before, this research limits the collection data in year retribution, author citation, and keywords in title and abstract. From the scope of limitation, research interest in maritime sector with technology aspect is described in figure 1. During that period, Dimension recorded or indexed 90 publications and more than average 60 publications have been cited by other publications in the database. **Figure 3** shows the percentage of publications with $\geqslant 1$ citations published in each year.

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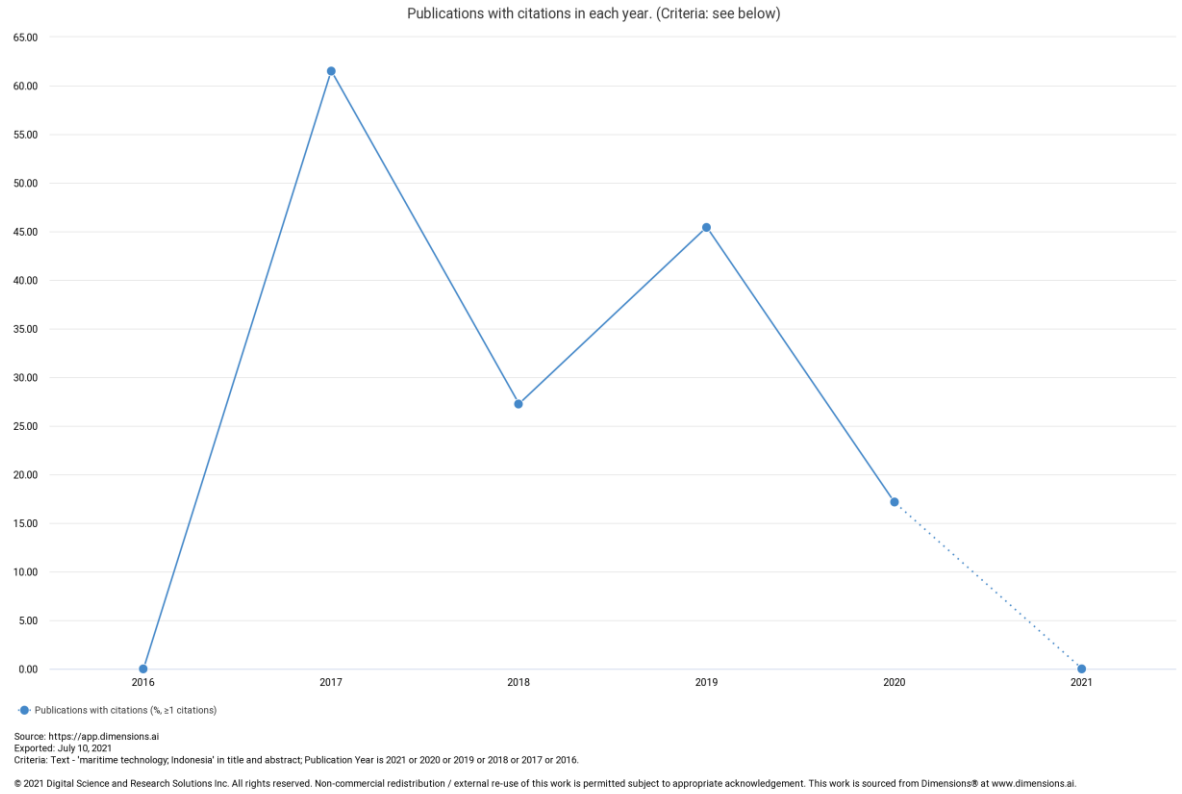

Figure 3. The Percentage of publication with ⩾ citation in each year. Publication citation is the number of times that publication have been cited by other publication in database.

The author is an important aspect to analyze for detecting research gap in maritime technology. Based on data retrieved, the visualization of distribution researchers with the most articles published or indexed can be seen in **Figure 4**.

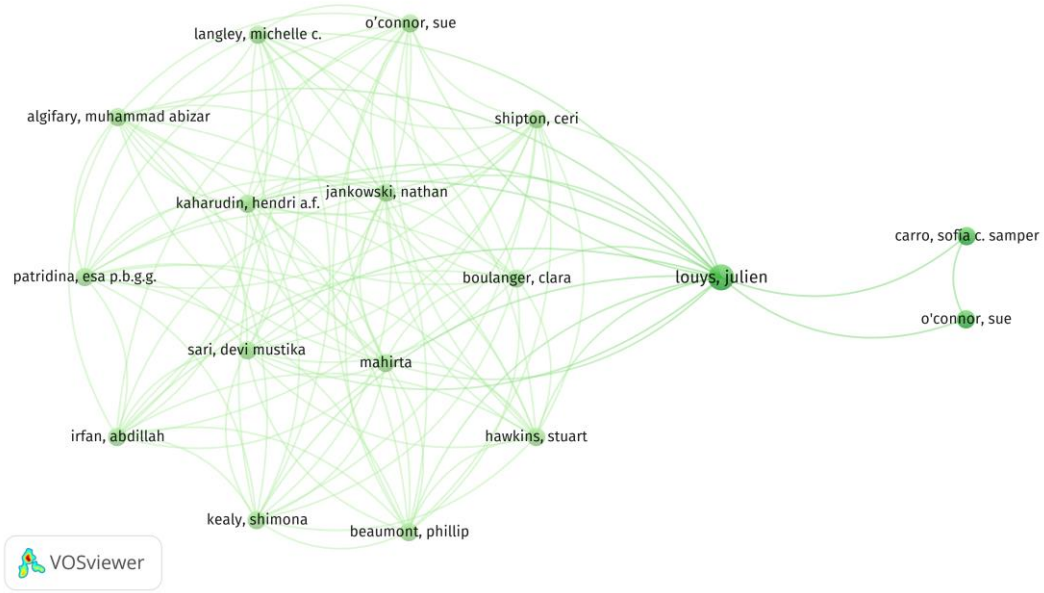

Figure 4. Author Clustering.

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From **Figure 4**, this research finds that the most contributions for maritime researches in aspect of technology come from Agustan and Oni Bibin Bintoro. Both researchers are affiliated to Agency for Assessment and Implementation Technology, Indonesia as known as Balai Pengkajian dan Penerapan Teknologi and They also published three papers related to the topic. There is another most contributed authors at **Table 1.**

Table 1. The COD and BOD values for the last week of the month (final clarification output).

Author	Affiliation	Number of papers
Agustan	Agency for Assessment and Implementation Technology, Indonesia	3
Oni Bibin Bintoro	Agency for Assessment and Implementation Technology, Indonesia	3
Deny Nusyirwan	Universitas Maritim Raja Ali Haji, Indonesia	2
Muhamad Sadly	Meteorological, Climatological, And Geophysical Agency, Indonesia	2
Julien Louys	Griffith University, Australia	2
Sue O'Connor	Australian National University, Australia	2

Dimension indexes the citation using some methods. There are Publication citations, Recent citations, The Relative Citation Ratio (RCR), Field Citation Ratio (FCR) and Patent citations (see https://plus.dimensions.ai/support/solutions/articles/23000018839-which-indicators-are-used-in-dimensions-and-how-can-these-be-viewed). The publication citations value is the number of times that a publication has been cited by other publications in the database. Citing publications can be of any publication type, such as articles, chapters, preprints, or monographs. The recent citations value is the number of citations that were received in the last two years. It is currently reset at the beginning of each calendar year. RCR indicates the relative citation performance of an article when comparing its citation rate to that of other articles in its area of research. A value of more than 1.0 shows a citation rate above average. The article's area of research is defined by the articles that have been cited alongside it. The Field Citation Ratio FCR is an article-level metric that indicates the relative citation performance of an article, when compared to similarly-aged articles in its subject area. A value of more than 1.0 indicates higher than average citation, when defined by Field of Research Subject Code, publishing year and age. Patent citations is the number of times that this record has been cited by other published patents. Patents may be registered in several offices, and this may affect patent citation data. The number of citations indexed by Dimension using publication citation is presented by this research at **Figure 5**.

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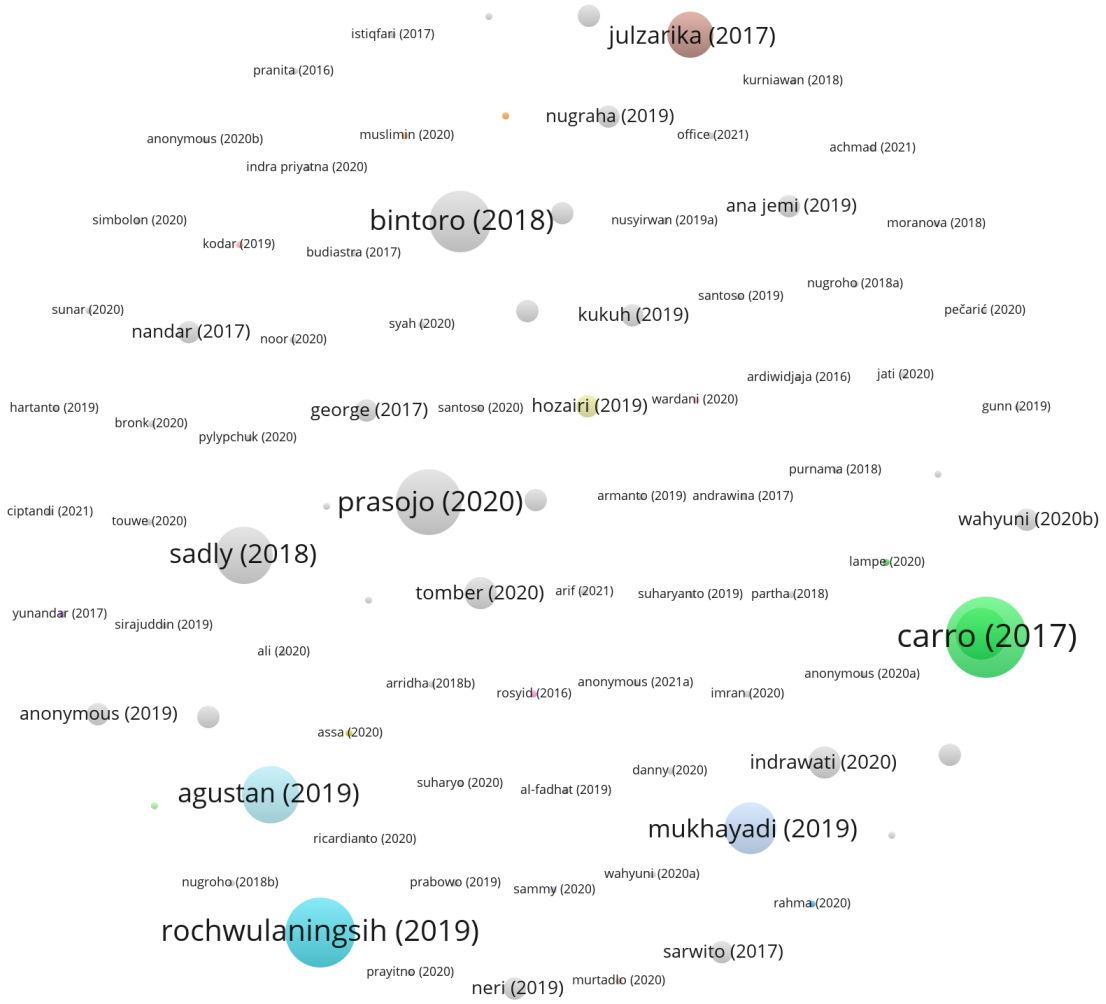

Figure 5. The clustering of citation from contributor.

The most cited by The Author “Julien Louys” from Griffith University, Australia. The Topic that referenced by Indonesian researcher is published by Agency for Assessment and Implementation Technology. The paper cited ± 8 times and published by titled “Combining Delphi Study and Scenario Planning for Indonesia Research Priorities in Maritime Sector”. There is another most cited articles in **Table 2**.

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Table 2. Most cited research paper.

Author and year	Titles	Number of citations
Julien Louys	Methodological considerations for Icthyoarchaeology from the Tron Bon Lei sequence, Alor, Indonesia	12 times
Agustan et al. (2019)	Combining Delphi Study and Scenario Planning for Indonesia Research Priorities in Maritime Sector	10 times
Oni Bibin Bintoro	Key Issues of the National Initiative for Indonesia Remote Sensing Satellite: Three rounds Delphi Study	7 times
Muhamad Sadly	An Application of SMART Method in vendor selection of Satellite Systems Case study of Indonesia Remote Sensing Satellite Systems (InaRSSat)	6 times
Deny Nusyirwan	The AT (The Amazing Technology) Introducing Maritime Area and The Potential of Kepulauan Riau using video visual and based on android as Media for Strengthen Children Knowledge at Coastline area	6 times

One of the advantages of Dimensions.ai is the possibility of controlling the Altmetric Attention Score. The impact on social networks, such as blogs, online newspapers, Twitter, or Facebook can also measure the interest of an article. **Figure 6** shows the average impact per altmetrics.

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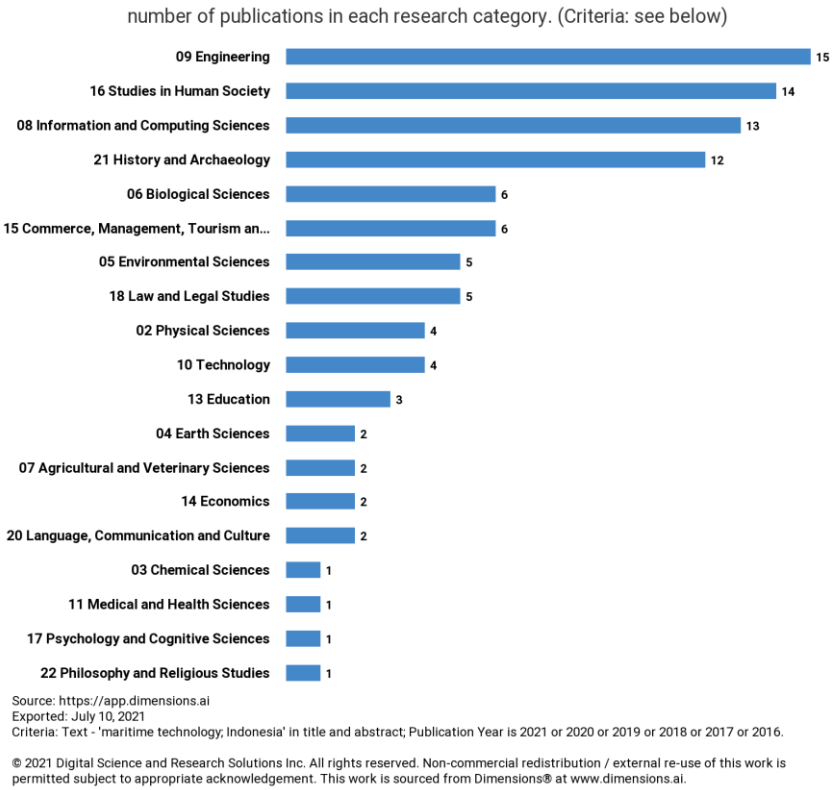

Figure 6. Almetric by field research.

As it can be seen, the biggest impact on social networks and other media is in the Engineering field. There are 15 articles indexed by Dimension related to engineering research field consists of 8 publications in geometric engineering, 3 publications in environmental engineering, 2 publications in electrical and electronic engineering, 1 publication in maritime engineering and 1 publication in materials engineering. The next step is describing the co-word analysis to find the research gap or other researches focus from clustered data. **Figure 7** depicts the clusters of the co-word matrix generated by VOSviewer.

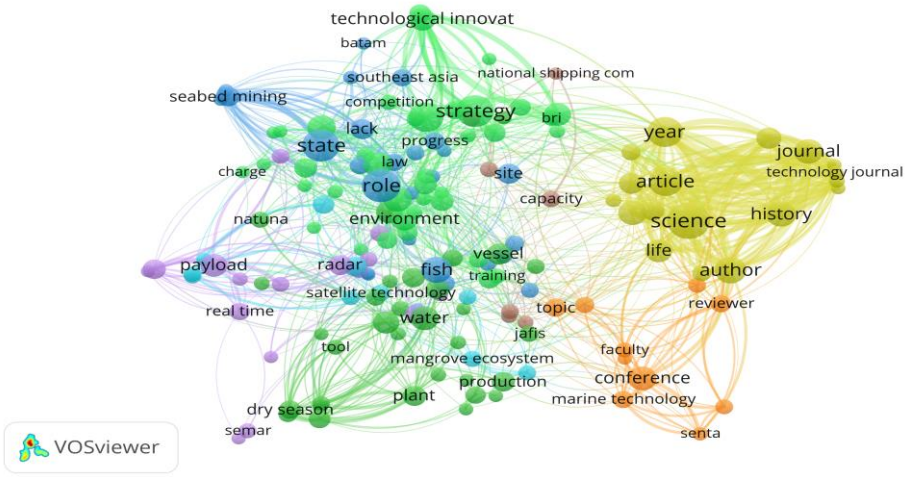

Figure 7. The visualization of co-words analysis results. The font and circle size of the keywords indicate the number of documents in which the keywords appear, while the color of a keyword' s circle displays the cluster to which this keyword belongs.

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The clustering process produced 8 clusters containing 161 keywords. from the clustered data, there are some research focuses can be generated as shown in **Table 3**.

Table 3. Most cited research paper.

Research Focus	Affiliation
Improvement in Strategic Aspect	Agency for Assessment and Implementation Technology, Indonesia Strategy, Strategic Alliance, Government Support, Technological Innovation, Smart Port, Opportunity
Maritime Affairs	Agency for Assessment and Implementation Technology, Indonesia Maritime Affairs, National Interest, Ministry, Operation, Production, limitation, maritime aspect, marine environment
Big Data and Internet of Things (IoT)	Analytical System, Simulation Program, Real Time, aviation Technology, Combination, Object
Smart System Approach	Mangrove Ecosystem, Case Study, Marine Technology, Natural Resources, Remote Sensing Technology, Smart Method, Stakeholder, national Shipping

4. CONCLUSION

Dimension as free used scholar database deliver a lot of data and information for researcher to help their research. In this bibliometric research, Dimension has answered several desired aspects of this research related to author, citation, keywords that are widely used and even determine the research focus that can be used to solve problems related to the lack of research in the maritime field in terms of technology. Some of the advantages possessed by Dimension are the added value shown in this study.

Furthermore, this research is still far from perfect. Similar bibliometric research using different database sources will produce better supporting data and can reduce the shortcomings of this study. In addition, different keyword approaches can also be used for further research than what has been done at this time.

AUTHORS NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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