

## A Bibliometric Analysis of Drinking Water Distribution In Coastal Areas Using Vosviewer

Vincent Aluna Ricardo<sup>1</sup>, Andri Irfan Rifai<sup>2</sup>, Amanatullah Savitri<sup>3</sup>, Joewono Prasetijo<sup>4</sup>

Universitas Internasional Batam<sup>1,2,3</sup>, Indonesia

Universiti Tun Hussein Onn<sup>4</sup>, Malaysia

E-mail: [vincentaluna20@gmail.com](mailto:vincentaluna20@gmail.com), [andri.irfan@uib.ac.id](mailto:andri.irfan@uib.ac.id), [amanatullah@uib.ac.id](mailto:amanatullah@uib.ac.id), [joewono@uthm.edu.my](mailto:joewono@uthm.edu.my)

\*Correspondence: [andri.irfan@uib.ac.id](mailto:andri.irfan@uib.ac.id)

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### KEYWORDS

drinking water; water distribution; water management; coastal area

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### ABSTRACT

This research aims to determine the trend related to drinking water distribution in coastal areas using VOSViewer software. Bibliometric analysis is a statistical method that could quantitatively analyze a research paper focusing on one topic mathematically. This research was analyzed using bibliometric analysis focusing on drinking water distribution in coastal areas. This research uses the bibliometric analysis method to examine a keyword. This method is often used to explore and analyze much scientific data. The Crossref database was used to retrieve approximately 1000 research with interrelated topics. Retrieved data is helped by using Publish or Perish and saving in RIS (Research Information System) extension. VOSViewer is also used to help process data into visualization. Drinking Water Distribution System has become the most dense keyword shown by VOSViewer. The publication is mostly in journal articles, totaling 549 out of 1000. Research on drinking water distribution systems in coastal area-related topics is continuously increasing by number year by year. With time stamps between 2000-2023, the highest peak was in 2023, with 75 publications in a year.

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### Introduction

Water is the most loaded natural resource on earth 96.54% of water is located in oceans, seas, and bays in the form of saline water, and 68% of freshwater is trapped in ice and glaciers (Water Science School., 2019). Water is a substance composed of the chemical elements hydrogen and oxygen and can be found in a few states, such as solid, gas, and liquid. Water on earth usually informs of a liquid state, making it very important for various living species such as humans, animals, and plants (Steven, 2023).

Drinkable water needs to grow daily, especially in coastal areas. Drinking water is a crucial resource needed to sustain life. Everyone must be able to access the drinking water supply (Pichel et al., 2019). Drinking water is described as water that consumption will not cause any health risks in the long term. Drinking water itself must be free from

tastes and odors. That is why all efforts must be made to achieve a supply of safe drinking water (Organization, 2019).

The coastal area is an area of transition between land and sea. The coastal area does have an essential role by providing an ecosystem and home to 40% of the world's population. Coastal areas are one of the most critical elements of the environment where diverse natural resources take place. This area is also used for several human needs and activities, such as agriculture, industry, transportation, recreation, and fishing, potentially becoming an energy source (Dewi & Bijker, 2020).

Indonesia has approximately 17,500 islands with 80,000 kilometers of coastal area. Over 220 million Indonesians live within 100 km of the coast, and 150 million depend on aquatic resources as their primary income (Kuzior & Sira, 2022). As a developing country, Indonesia took its coastal area seriously to grow its economy. It is used for tourism spots, marine transportation, fish cultivation, offshore activities, naval industries, and resource extraction points. With the importance of coastal areas, we should provide people who live in coastal areas with easy access to basic needs, especially drinking water (Pramita et al., 2021).

There have been studies on achieving safe drinking water, but only a few research about drinking water bibliometric analysis using VOSViewer (Al Husaeni & Nandiyanto, 2022). VOSViewer is used to create publication maps, country maps, or journal maps based on a network or to build keyword maps based on networks or relationships between existing items. At VOSViewer, we can remove the irrelevant keywords after entering the desired keywords. (Yu et al., 2020).

This research aims to determine the trend related to drinking water distribution in coastal areas using VOSViewer software. Bibliometric analysis is a statistical method that could quantitatively analyze a research paper focusing on one topic mathematically. Doing bibliometric analysis could also show most areas of most publications and discover further research opportunities related to drinking water.

This study aims to explore the novel application of bibliometric analysis, specifically using VOSViewer software, to investigate trends in drinking water distribution in coastal areas. While previous research has addressed safe drinking water and its importance, there remains a gap in utilizing bibliometric methods to systematically analyze the literature in this specific context. By employing VOSViewer, this research intends to generate publication maps, identify key contributors, and map out emerging themes and collaborations within the field of coastal drinking water supply. The novelty lies in applying advanced analytical tools to comprehensively assess the breadth and depth of existing research, potentially uncovering new insights and directing future research directions. The findings from this study are expected to benefit policymakers, researchers, and stakeholders involved in coastal management and water resource planning by providing a structured overview of current knowledge, highlighting gaps, and suggesting avenues for further investigation. Ultimately, this research endeavors to contribute to the sustainable development and management of coastal areas, ensuring equitable access to safe drinking water for coastal populations amidst growing environmental and socio-economic challenges.

## **Literature Review**

### **Drinking Water**

The world economy has a major reliance on the availability of freshwater. A reliable water source is a must for human consumption, agriculture, recreation, and industry. Achieving freshwater nowadays is challenging because of contamination (Sharma &

Bhattacharya, 2017). Every human has a fundamental right to safe, clean water regardless of nationality, wealth, or even color. Safe drinking water can prevent all humans from transmitting diseases such as diarrhea, cholera, polio, and dysentery (Li & Wu, 2019).

Despite the critical roles of drinking water, in some parts of the world, some communities find it hard to have access to drinking water. This caused several possibilities, starting from water scarcity, water pollution, or even ineffective governance in the case of fixing water scarcity in the area (Dos Santos et al., 2017). More problems like economic growth, demographics, new technologies, social changes, and possibly law policies could lead to hard access to drinking water.

Having an acceptable quality of physical, chemical, and bacteriological parameters so it can be used safely for consumption is the definition of drinking water (Gadgil, 1998). Nowadays, water is contaminated easily by chemicals, heavy metals, and bacteria, which makes it unable to be consumed. Contaminants can be identified by looking at the color or taste of the water; however, most contaminants can't be identified unless tested (Sharma & Bhattacharya, 2017). Implementing water quality control is crucial to help prevent the spread of disease caused by contaminated water and meet health quality standards.

### **Water Management**

Now, the world population is 7.7 billion and is expected to double in the next half-century. The growth of the population will be caused by increasing demands for good-quality water. The standards for adequate living at least need a renewable water supply of about 2000m<sup>3</sup> for a single person. As we know, almost all of the water we have on the planet is stored in the ocean, the remaining is stored in forms of ice, and the remaining 1% is in the form of freshwater (Bouwer, 2000).

To achieve a safe level of drinking water, we also need a good management system. Water management has a strong relation with engineering on how to solve environmental problems with a technical-based solution. Water management relies on preventing extreme conditions and limiting the risk with a technical-based solution such as dikes, reservoirs, and dams (Pahl-Wostl et al., 2008).

We will not run far from good infrastructure to achieve a good level of water management. Water infrastructure is not just dams or reservoirs; it includes everything that helps supply water to everyone, such as pipes, pumps, levees, and even a water treatment plant. Humans have relied on this infrastructure since the dawn of civilization (Crow-Miller et al., 2017).

### **Coastal Area**

A well-managed coastal area zone is a free-gifted natural resource for a country. A well-managed coastal area can have a significant impact on urban life. That makes a good planning and management system needed. One of the excellent management is by providing safe drinking water. Coastal people often face problems related to scarcity, contamination, and salinity intrusion (Abedin et al., 2014).

Salinity intrusion has become one of the significant issues in coastal areas. These issues are caused by climate changes that make seawater rise and threaten the quality of drinking water. The amounts of water contaminated with seawater create a new problem to ensure everyone has access to drinking water. The growth of the population in coastal areas usually overlaps with the development of water infrastructure (Purnama & Marfai, 2012).

## Research Methods

This research uses the bibliometric analysis method to examine a keyword. This method is often used to explore and analyze much scientific data. It can help discover the trends of the articles and collaboration patterns. This gives the bibliometric analysis a role in providing information to open further research on drinking water management (Tiwari et al., 2023).

To help our research, we are using software called VOSViewer. VOSViewer is a tool used to visualize co-authorship and citation networks. VOSViewer can be used to collect relevant bibliographic data from a domain. Many types of publications can be pulled from VOSViewer, such as scholarly articles, conference papers, books, and other kinds of forms (Velmurugan, 2021).

To retrieve the citation we need for VOSViewer, we can use Publish or Perish, which is a tool that functions to retrieve and analyze citations from academic databases such as Google Scholar. Publish or Perish is used by searching the keyword and publication year relevant to the research. Moreover, even check the impact or influence of specific publications.

## Results and Discussions

Publish or Perish version 8.9.4 was used on October 8, 2023, to retrieve approximately 1000 publications through crossref. One thousand data were retrieved using Publish or Perish, which results from the review of keywords such as Drinking Water, Water Distribution, Water Management, and Coastal Areas. The resulting data is interrelated with the research topic by using Publish or Perish to help us retrieve data.

With the data retrieved, we can make it into a new information form with the help of Microsoft Excel. The data we retrieve shows us at least citation count, author name, and year. With the information provided and the help of Microsoft Excel, we made it into a chart or figure to show a comparison. VOSViewer is also used to provide a picture of visualization between research keywords.

### Research Keyword Connection

The relationship between each keyword retrieved from VOSViewer can be seen (Figure 1). The most dominant keyword is "Drinking Water Distribution System." This is identified by solid color and connection to other keywords.

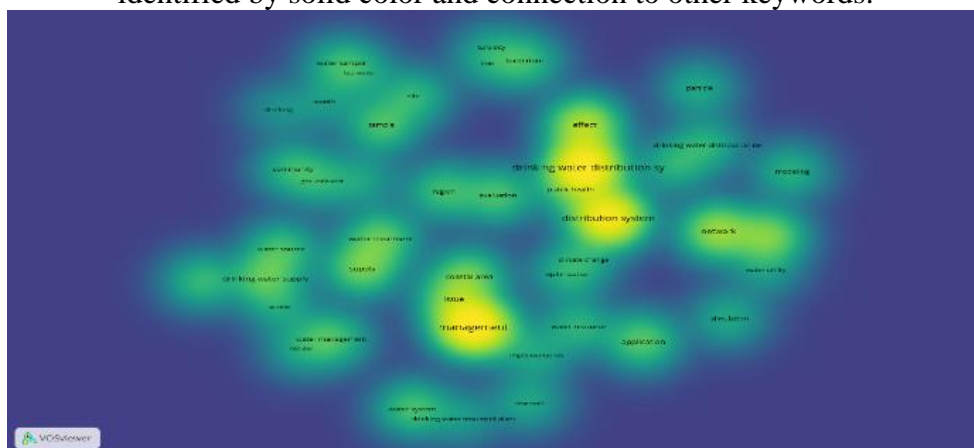
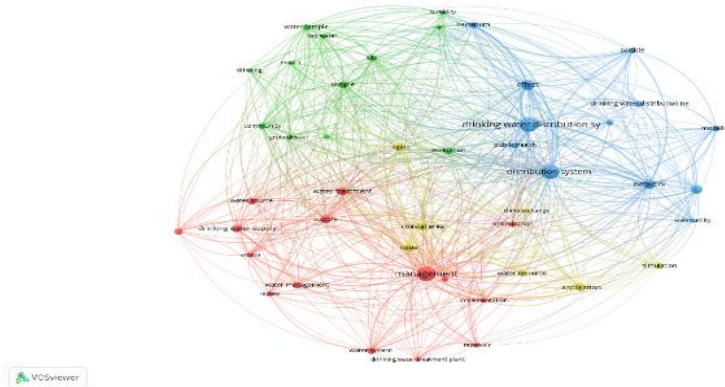


Figure 1. Network Visualization Between Keyword by VOSViewer

### Distribution of Research Year

Publish or Perish provides many kinds of data. We can retrieve the distribution of the research year by using Publish or Perish. The data we retrieve from publish or perish is then processed into a chart through an Excel application (Figure 2.).

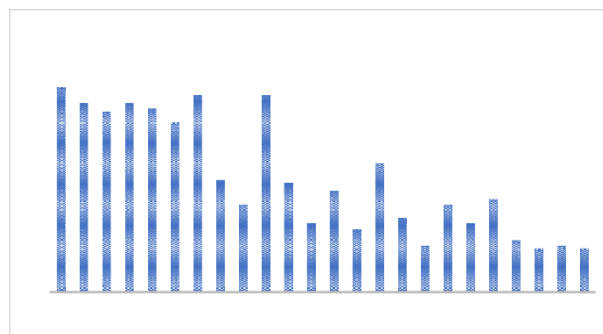


**Figure 2. Distribution of Research Years**

The chart exported by Excel explains research that happened between the years 2000-2023. A significant increase in the amount of research can be seen within the years 2012-2014. The year 2023 became the most researched, with 75 of the total.

### Density of The Research Keyword

The density of the research keyword is one of the few data that can be obtained by using VOSViewer. This data visualizes the keywords through data we obtained from Publish or Perish. Drinking water, water distribution, water management, and coastal areas are the keywords used (figure 3).

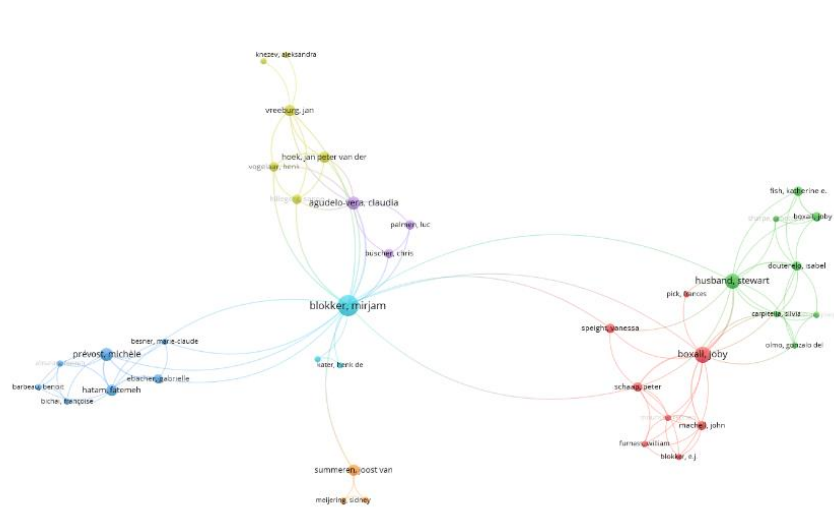


**Figure 3. Keyword Density by VOSViewer**

The “Drinking water distribution system” keyword becomes the densest among other keywords shown by the deepest color. A few other keywords, such as distribution system and management, also have almost the same density. This shows that the keywords are attached.

### Influential Authors

By using VOSViewer, we can conduct a co-authorship analysis, which can help us identify the author's name. By providing this type of data, we can load the top authors and list them by rank based on documents. Figure 4 shows us the top 38 authors.



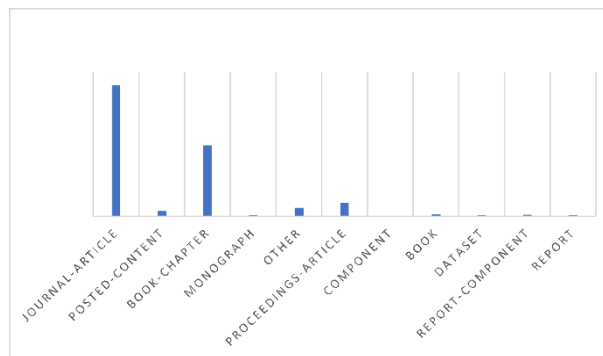
**Figure 4. Authors Visualization by VOSViewer**  
**Table 1. Publication author analysis.**

Authors	Number of Documents
Jayawardena, a. w.	15
Dore, mohammed h	13
Spellman, frank r.	12
Blokker, mirjan	10
Cantor, abigail f.	8
Smith, kirk p.	7
Ostfeld, avi	7
Bouri, salem	6
Boxall, joby	6
Husband, stewart	5

Table 1 describes the author's name with the amount of related publication topics. The name is listed in order by rank determined by the number of documents. From Table 1, we can conclude that Jayawardena, a.w. Become the number 1 author with the highest number of 15 documents, followed by Dore, Mohammed h. with 13 documents, spellman, frankr. With 12 documents, blokker, mirjan 10 documents, cantor, abigail f. 8 documents, while Smith, kirk p. and ostfeld, avi 7 documents, followed by Bouri, salem , Boxall, joby 6 documents, and Husband, stewart with 5 documents. Those are the top 10 authors with the highest total of related publications, there are still many other authors that related to the topic that can't be counted.

**Publication Types Analysis**

By using Publish or Perish database, we can obtain publication types as one of the information to use. The data collected from the publish or perish then will be exported to Microsoft Excel to be processed (**Figure 5.**) The data then turned into a chart to explain the most popular types of publications to be used related to the topic.



**Figure 5. Types of publications retrieved from Publish or Perish**

Figure 5 explains that of 1000 publications, almost 55% are published in journal–article form. This is followed by Book- Chapter form with 297 publications or 29.7% of 1000, while 15.3% of 1000 is published in other form.

## Conclusion

The research of “A Bibliometric Analysis of Drinking Water Distribution in Coastal Area Using VosViewer.” This research provides numerous amounts of data from publish or perish to be used on VOSViewer. Publish or Perish can be easily used to gather up to 1000 research with RIS (Research Information System) format. This research resulted in the “Drinking Water Distribution System” keyword being most dominant by VOSViewer. From the data retrieved, the trend of research with related topics reached its peak of 75 publications by December 12, 2023. Half of the research related to the topic is published in Journal – Article form. From this research, the "Drinking water Distribution in Coastal Area" topic is experiencing growth from year to year especially last 10 years when Drinking Water still become a problem for some communities.

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