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BIBLIOMETRIC ANALYSIS OF URBAN DRAINAGE FLOOD MANAGEMENT

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ABSTRACT

Floods are a frequent and challenging disaster, caused by factors such as heavy rainfall and improper waste disposal in drainage systems, leading to significant material and non-material losses. Effective measures are needed to mitigate flood impacts. This study uses bibliometric analysis to explore methods for flood disaster management, employing Publish or Perish software to filter relevant journals from Crossref. The data, including research titles, authors, publication years, and journal sources, is processed using VOSViewer software. The analysis shows that keywords like rainfall, drainage, and flood mitigation are central to the research, highlighting strong interconnections. The diversity of publishers and research types contributes to a global perspective, forming a solid research foundation. The study also tracks the growth of research on flood management in drainage channels from 2016 to 2023 and identifies diverse geographical case study regions. This analysis underscores the continued relevance and potential of this research to support effective global flood mitigation strategies.

Keywords: Flood; Mitigation Flood; Rainfall; Drainage

Introduction

At this time, floods have become one of the disasters that often occur and have not been resolved properly. Flooding is a condition where overflowing rainwater inundates the road surface. Flooding can occur in areas that do not have a good drainage system so that rainwater that falls cannot be accommodated by drainage (Abdul Muin & Rakuasa, 2023). Flood disasters always cause many losses, both material and non-material losses. Floods can cause damage to residential areas, damage to the environment, and can cause casualties (Sisi Febriyanti Muin, Boer, & Suharnoto, 2015).

Flood disasters can be caused by many factors, ranging from rainfall factors to the habits of people who throw garbage in drainage channels. High rainfall is the most important factor in causing floods (Prabawadhani, Harsoyo, Seto, & Prayoga, 2016). High rainfall increases the amount of water that falls to the ground surface in large quantities and results in a flow of water so fast that it can not be accommodated by the normal capacity of drainage (Adiwangsa, Lukito, & Irawan, 2023).

Another cause that can cause flooding is land use shift (Tollan, 2002). Along with the population growth that always increases every year, the need for housing, transportation, and resources also increases following the increasing population. This has caused many changes in land use, which initially turned into forests or green land,

converted into roads and settlements (Akhirul, Witra, Umar, & Erianjoni, 2020). As a result of the large amount of land use change, the catchment area for rainwater is decreasing. When it rains, rainwater is not absorbed into the soil so the flow above the ground surface is greater which will have an impact on the normal capacity of drainage channels (Rohyanti, Ridwan, & Nurlina, n.d.).

The existing design of the wrong drainage channel can also cause flooding, the existing size of drainage that is not by rainfall will cause falling water cannot be accommodated drainage (Augustine & Akinlolu, 2015). Not only that, garbage that accumulates and sedimentation in drainage channels can make the size of drainage smaller, which causes drainage to decrease capacity (Septian et al., 2020). Topographic factors can also cause an area to be flooded. Lowlands and basin areas are the most prone areas to flooding (Annisa, 2023).

Therefore, to reduce the impact of flooding, there needs to be proper handling in overcoming floods. Flood management can be done in various ways, including analyzing the potential distribution of flood areas (Zope, Eldho, & Jothiprakash, 2016). Analysis of flood areas was carried out using topographic, rainfall, land use, and river flow patterns (van Duin et al., 2021). In addition, normalizing drainage can prevent flooding from occurring (Adi, 2013). This study used bibliometric analysis to determine methods that can be used in flood disaster management. This study used VOS Viewer software, which was used to help analyze previous research. By using VOS Viewer software, researchers can visualize bibliometric networks that can help in developing this research.

Literatur Review

Flood Disaster

In general, flooding can be interpreted as an event where water capacity increases and cannot be accommodated by drainage channels (Nurdiawan, 2018). Floods can be grouped based on two main factors, namely the mechanism of occurrence and the location of flood sources in inundated areas. In terms of the mechanism of occurrence, there are two main types, namely ordinary floods and unusual floods. Flooding is common when rainfall is very high, exceeding the ability of the sewerage system to contain it. Floods are unusual, on the other hand, caused by external factors such as tsunamis, tidal waves, river overflows, shipments, or tidal floods (Arif, 2019).

The types of floods that often occur are ordinary floods, shipping floods, flash floods, tidal floods, and cold lava floods. Shipment flood is an event when river water overflows due to heavy rain that occurs in other regions (Adi, 2013). A flash flood is a type of flood disaster that contains mud, stone, and wood materials, has a great potential for damage, and occurs quickly when passing through an area (Napitupulu & Makfi, 2023). Rob flooding is a type of flood that occurs when sea water rises or high waves flood an area that has a lower elevation than sea level (Putri et al., 2023). Cold lava floods are floods that occur as a result of volcanic eruptions, where the eruption produces cold lava that causes rivers to overflow, allowing muddy water to flood the surrounding area (Salim, 2018).

Floods can cause many material and non-material losses that affect the community (Louw, Olanrewaju, Olanrewaju, & Chitakira, 2019). Floods cause damage to infrastructure, settlements, and public facilities. Damaged infrastructure will require enormous costs for repairs (Paterson, Wright, & Harris, 2018). Not only flood disasters can also cause residential damage, but buildings that are flooded will experience damage to parts of the building so the building becomes unsafe to live in.

In addition, floods have an impact on health. This flood disaster can cause serious impacts on human health, resulting in disease outbreaks being the most common thing (Nurdiantoro & Arsandrie, 2020). Flood water polluted by bacteria and viruses will cause skin and digestive diseases. Not only that, floods also have an impact on mental health. People affected by floods will lose their homes and property, which can lead to stress, depression, and anxiety (Hu, Zhang, Shi, Chen, & Fang, 2018).

Causes of Flooding

Rainfall is a common event in Indonesia, considering that Indonesia is located in the tropics. High-intensity rainfall is the main factor affecting the occurrence of floods (Ginting, 2021). Floods caused by rainfall usually occur due to the inability of drainage channels to accommodate large volumes of water that come suddenly (Merten et al., 2020). When drainage channels cannot collect rainwater, rainwater will overflow into the streets causing catastrophic flooding

This condition can be exacerbated by the large urbanized area and irregular land use. Improper land use, such as deforestation and wetland conversion, can reduce the natural ability to absorb and store rainwater (Rizkiah, 2015). In cities, rapid urbanization often leads to surfaces that cannot absorb water, such as concrete and asphalt, the increase in concrete and asphalt-coated surfaces inhibits groundwater absorption, which then causes rapid water flow towards drainage channels (Rahayu et al., 2023).

The topography of an area also affects the risk of flooding (KAHARAP, 2023). Topography is a form of the earth's surface that includes the slope and height of an area, which is in the form of slopes or plains. Areas with steep slopes tend to be more prone to flash floods, where heavy rainwater rushes into rivers and causes high-intensity flooding. In flat areas, regular flooding can occur because water is difficult to flow and stagnant on the ground surface (Fikri, Tjendani, & Oetomo, 2023).

Poor drainage infrastructure or ineffective drainage design are also factors that can cause floods when it rains. Clogged or poorly maintained drainage channels can result in water not being able to flow smoothly, causing waterlogging and increasing the risk of flooding (Min & Tashiro, 2024). Drainage channels often experience ineffectiveness due to garbage accumulation and sedimentation. Garbage that accumulates can impede the flow of water, cause waterlogging during heavy rainfall, and damage the physical structure of channels. Sedimentation can also reduce the capacity of channels to hold excess water (Zakaria et al., 2017).

Flood Disaster Mitigation

To reduce the risk of damage to settlements due to flooding, preventive and mitigation measures need to be implemented. Action can be in the form of mapping flood-prone areas (Hidayat, Darnila, & Afrillia, 2023). Mapping of flood-prone areas is

needed as a reference to implement flood disaster mitigation measures. Through this mapping, flood-prone points and ineffective drainage channels can be identified, so that drainage canal improvements can be carried out more efficiently (Sari et al., 2021).

To reduce the frequency of floods, infrastructure improvement measures are needed. This action involves improving drainage and normalizing drainage. Improvement and normalization of drainage can increase the capacity of drainage channels to be wider. By ensuring the channel has sufficient capacity to hold a high volume of water, the risk of flooding can be reduced as the channel can handle a larger water load (Soeryamassoeka, Gunarto, Rahmanto, & Nurcahyo, 2023).

To prevent and reduce the adverse effects caused by floods, the role of flood control buildings is very important. These buildings, which are often dams, embankments, or infiltration wells, have several crucial functions that can reduce the risk of flooding. Flood control buildings can control water discharge to minimize overflow of water and flood control buildings in the form of infiltration wells can collect water from rainwater (OKTAVIYANI, 2023).

The role of the community is also very important in reducing the impact of floods. The community needs to get an education program to increase public understanding of the impact of flood disasters how to deal with flood threats and how to overcome floods. The education provided can be in the form of the importance of maintaining drainage channels and the risks that can occur due to drainage channels that cannot work effectively. Thus, the community can also play an active role in reducing the impact of floods (Lestary, Zulfah, & Astuti, 2023).

Research Method

In this study, the methodology used was the bibliometric approach method. Bibliometric analysis is a method carried out by analyzing scientific literature belonging to previous researchers (Hanifah, Abdillah, & Wachyudi, 2022). Bibliometric analysis can be done by identifying research trends and publication characteristics related to keywords related to the research discussed. In this study, the journals that will be identified based on the topic discussed are flood management in drainage channels. The collection of articles and sources in this study uses Publish or Perish software. Publish or Perish software is used to filter journals using keywords according to the topic discussed, namely handling floods in drainage channels. Journals are filtered using sources from Crossref and then the results are presented in the form of research title, researcher name, year of research, and journal source. After obtaining the data, the data is processed using VOSViewer software. The function of VOSViewer software is to map the data that has been obtained from the Publish or Perish software in visual form [38].

Result And Discussion

In this study, the results and discussion were based on data obtained through Publish or Perish and VOSViewer software. Keywords used in Publish or Perish software for this study include flooding, flood mitigation, drainage channel capacity, and rainfall. The data obtained is in the form of research title, researcher name, year of

research, and journal source which is then mapped using VOSViewer software.

Keywords Connection

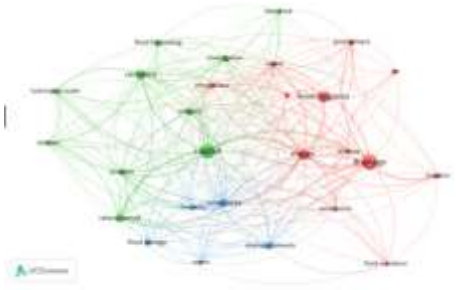

Figure 1
VOSViewer Network Visualization

Based on the analysis of VOSViewer software using data from Software Publish or Perish, a visualization map as shown in Figure 1 was obtained. Based on the visualization results from Figure 1, it was found that the keywords drainage, rainfall, and flood mitigation have the most related connections between topics.

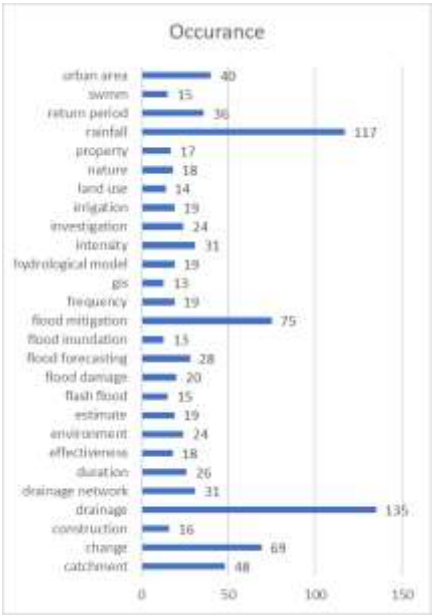

Figure 2
Keywords Graph According to Occurrence

The data graph of Figure 2 shows keywords based on events. The picture shows that the keywords drainage, rainfall, and flood mitigation are the keywords based on events. These keywords are the main keywords in researching flood management analysis in drainage channels. Although these keywords are the main keywords, other keywords are still a reference.

Research Keywords Density

Based on Figure 3 which is the result of analysis using VOSViewer, some keywords have brighter colors than other keywords that indicate the level of keyword density.

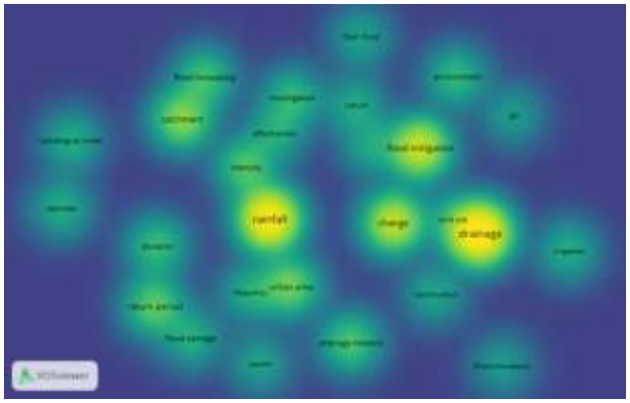

Figure 3
Density Visualization Keyword

The keyword density level refers to how closely related the elements in the network are. In network analysis, density is calculated as the ratio between the actual number of connections and the number of possible connections in a network. If the network has many connections between elements, then the density is high. In this study, 3 keywords have a high level of density, namely rainfall, drainage, and flood mitigation. This shows a close relationship between flood mitigation, rainfall distribution, drainage, and other keywords

Research per Year

Based on the results of journal networking using Publish or Perish software, there are increases and decreases in research every year. The vulnerable journal year used in this screening starts from 2000 to 2023.

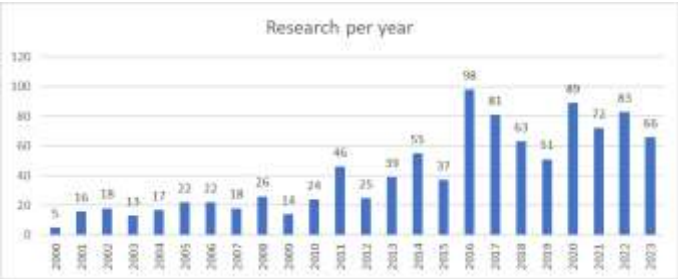

Figure 4
Research Data Yearly

Based on figure 4, from 2000 to 2010 the number of studies on flood management was still low, indicating that the topic of research on floods in that year was still less relevant. But from 2011 to 2015, the number of studies on the topic began to be widely researched and from 2016 to 2023, the number of studies on floods was very much studied by researchers. This indicates that research on flood management has

experienced consistent and significant growth. The increase in research in flood management every year reflects that this research topic is still interesting to research.

Research Publisher and Type

Table 1
Journal Publisher

Publisher	Amount
Wiley	154
CRC Press	101
Copernicus GmbH	91
American Society of Civil Engineers	47
Elsevier	44
Springer International Publishing	35
MDPI AG	32
ICE Publishing	30
Korean Society of Hazard Mitigation	29
Springer Science and Business Media LLC	24

Based on Table 1, in research on the topic of flood management, there are shares of journal publishers from journals that are netted at the time of journal collection. Various publishers have an important role to play in gathering references. With a variety of publishers who have very high-quality research results, article writing will have diverse content globally.

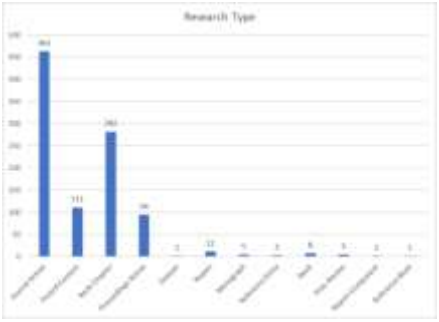

Figure 5
Resarch Type

Not only that, research on these topics also has references from various types of research. Not only through research articles, but research also takes references from other sources such as posted content, books, book chapters, reports, proceedings, datasets, and monographs. Various types of research that become references in making articles, will provide an understanding of the relevance, comparison, and continuation of the research to be made. Thus, the diverse use of references provides a solid basis and validity for the article.

Research Case Studies

Table 2
Case Study

Case Study	
Bangladesh	Algeria
Indonesia	China
Italia	Spanyol
Ethiopia	Rusia
Nigeria	Taiwan
Jepang	Korea Selatan
India	Yunani
Jerman	Iran
Myanmar	Austria
Inggris	Ghana
Amerika	Turki
Belanda	Pantai Gading
Filipina	

Based on table 2 which is the result of a case study analysis of journals netted in VOSViewer software, research on the topic of flood management has case studies in various countries in Asia to Europe. References from leading journals containing case studies in different countries with different drainage conditions provide a solid basis for looking at how different countries are dealing with flood challenges and designing solutions that are appropriate to local conditions. Therefore, further research on this topic is still relevant and can provide deeper insights to support the development of effective flood mitigation strategies around the world.

Conclusion

This study uses bibliometric methods to analyze research trends on the topic of flood management in drainage channels. Journal data collection using Publish or Perish software, then mapped using VOSViewer by entering keywords related to flood management in drainage channels. The results of the analysis show that keywords such as rainfall, drainage, and flood mitigation have a close relationship between keywords, indicating that these keywords are the main focus of the research. In addition, this study also displays the publisher for each study and type of research. The journals collected by Publish or Perish software come from various publishers and have various types of research. With the diversity of publishers and types of research, the articles produced become globally diverse and provide a solid foundation for research. This study also

analyzed the publication year of the research that has been collected. Research on the topic of flood management in drainage channels shows consistent growth from 2016 to 2023. Analysis of case studies in collected journals shows a wide variety of case study areas. Through this analysis, it can be concluded that research on the topic of flood management in drainage channels remains relevant and can provide deep insights to support the development of effective flood mitigation strategies around the world.

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