



Bibliometric Analysis of Sedimentation at Petrochemical Port Using Vosviewer

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ABSTRACT:

Sedimentation at docks represents a critical concern in coastal and inland water environments, where the dynamic interplay of natural processes and human activities can lead to the gradual accumulation of sediments. The presence of sediment near ports can lead to difficulties in navigation, reduced water depths, and higher costs for upkeep. By comprehensively consolidating and evaluating the current understanding of sedimentation at ports, extensive analysis will offer vital insights that will inspire academics to further their research and make significant advancements in tackling the difficulties related to sedimentation in port environments. This study utilizes quantitative methodologies, using VOS Viewer and Publish and Perish, specifically descriptive and correlational designs, to elucidate characteristics, trends, and relationships related to the research topic. The connectivity is demonstrated through the Network Visualization Diagram and Density Visualization Diagram, which show a significant interconnectedness among the keywords. The primary utilization of data mainly consists of books and journals. The trend showed a fluctuation in 2004, with the highest peak occurring in 2016. This bibliometric analysis suggests that the ongoing discussion about sedimentation in dock environments remains relevant.

Keywords: Abrasion, Dredging, Erosion, Port, Tide Fluctuation, Sedimentation Control.

INTRODUCTION

Sedimentation at docks represents a critical concern in coastal and inland water environments, where the dynamic interplay of natural processes and human activities can lead to the gradual accumulation of sediments (Al-Shammmary, 2023; Newton et al., 2020). Ports, crucial elements of waterfront infrastructure, act as points of connection between land and sea, making them susceptible to sediment deposition (Bianchini et al., 2019; Herrera-Franco et al.,

2021). The deposition of particles near and beneath ports impacts navigational channels and presents difficulties to the structural stability of major maritime facilities (Parthasarathy & Deka, 2021; Porcino et al., 2024). Sediments can impede vessel entry, requiring expensive dredging operations and affecting the general functionality of the port (Pellegrini et al., 2020). Comprehending the patterns and factors that cause port sedimentation is crucial for developing efficient management strategies that guarantee these vital maritime facilities' long-term durability and operational effectiveness (Mörtl & De Cesare, 2021; Nogué-Algueró, 2020).

Sedimentation is a crucial process in geology, hydrology, and environmental science. It refers to settling solid particles in a fluid medium, most observed in water bodies (Celeste A. De Asis, 2020). This natural phenomenon is a vital determinant of the physical characteristics of rivers, lakes, and coastal areas (Popović et al., 2021). Sedimentation refers to depositing mineral and organic particles, which changes riverbeds' composition and impacts the overall health of aquatic ecosystems (Hauer et al., 2018). The complex interaction of gravitational forces, water currents, and particle properties determines sediment movement and settling (Sun et al., 2018). Comprehending sedimentation is essential for evaluating environmental shifts, overseeing water supplies, and understanding the geologic history of locations.

Ports, vital elements of marine infrastructure, have diverse functions of enabling ship entry, overseeing cargo operations, and offering areas for leisure pursuits (Elhag & Bahrawi, 2019). Due to their advantageous positioning near bodies of water, they are susceptible to the ever-changing forces of sediment movement, which are influenced by factors such as tidal fluctuations, river discharges, and human activities (Lojek et al., 2020). The presence of sediment near ports can lead to difficulties in navigation, reduced water depths, and higher costs for upkeep (Guarnieri et al., 2021; Polrot et al., 2021). Hence, the research in this domain is focused on thoroughly comprehending the sedimentation processes that impact ports. This entails the execution of efficient control methods and the formulation of sustainable plans to guarantee the ongoing functionality and resilience of these crucial structures (Al-Shammary, 2023).

The main aim of this study is to comprehensively consolidate and evaluate the current understanding of sedimentation at ports. By doing a thorough literature evaluation, our goal is to pinpoint areas where knowledge is lacking and define specific objectives for future study in this field. Moreover, bibliometric analysis has been performed to identify crucial subjects, notable authors, primary sources, highly referenced papers, and the nations making substantial contributions to the literature on sedimentation and ports (Rojas-Sánchez et al., 2023).

The main objective of this extensive analysis is to offer vital insights that will inspire academics to further their research and make significant advancements in tackling the difficulties related to sedimentation in port environments (Ferrario et al., 2022; Gustafson, 2021). Increasing fascination with utilizing tidal energy as researchers assess its viability and ecological

implications. This research identifies knowledge gaps in port sedimentation, offering insights for further studies and promoting tidal energy utilization and ecological impact assessment, significantly contributing to understanding sedimentation and renewable energy technologies.

RESEARCH METHODS

This study utilizes quantitative methodologies, specifically descriptive and correlational designs, to elucidate characteristics, trends, and relationships related to the research topic. With a specific focus on ports, the research aims to comprehend the existing body of knowledge regarding sedimentation and water structure. These quantitative approaches are informed by established theoretical frameworks, guiding the systematic investigation of sedimentation processes within ports. A Bibliometric Analysis is suitable to achieve this objective, facilitating a comprehensive exploration and synthesis of relevant scholarly contributions in the field.

The data collection instrument employed is Publish and Perish, utilizing Crossref and Semantic Scholar as primary data sources to acquire raw citation data. Subsequently, the obtained data is systematically sorted based on the keywords employed in this paper, ensuring the inclusion of pertinent references. The construction and visualization of bibliometric networks are facilitated by utilizing VOS Viewer as the analytical tool. Based on the gathered and processed data related to the given keywords, the resulting density visualizations and bibliometric networks provide insights into the relationships among academic publications.

The data employed in this study were gathered through the utilization of specific keywords, namely "Sedimentation Control," "Tide Fluctuation," and "Petrochemical Port." Additional keywords were incorporated to ensure the retrieval of relevant references. The inclusion criteria for this analysis encompassed a manual review of 1000 pertinent documents identified in Crossref and 57 in Semantic Scholar. After eliminating 163 irrelevant documents and normalizing author and journal names, 930 papers were consolidated into a .xlsx file. An analytical tool was employed for network visualization and graph creation to conduct a comprehensive analysis based on keyword relevance, density, publication year, publisher, publication source, and research type.

RESULTS AND DISCUSSION

Research Keyword Relevance

Network Visualization is one of the outcomes of collecting scientific articles obtained with Publish and Perish, facilitated with VOS Viewer. The diagram visualizes how a keyword on the scientific paper or publication aligns with the selected keywords. The title and abstract are chosen to be the field from which the term will be extracted by ignoring the structure of abstract labels and copywriting statements. The binary counting method is an efficient approach to minimizing the

number of terms considered. The network diagram displayed is the result of selecting relevant keywords from all the scientific articles that have been collected.

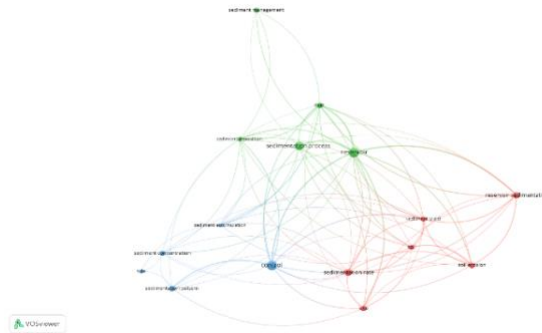
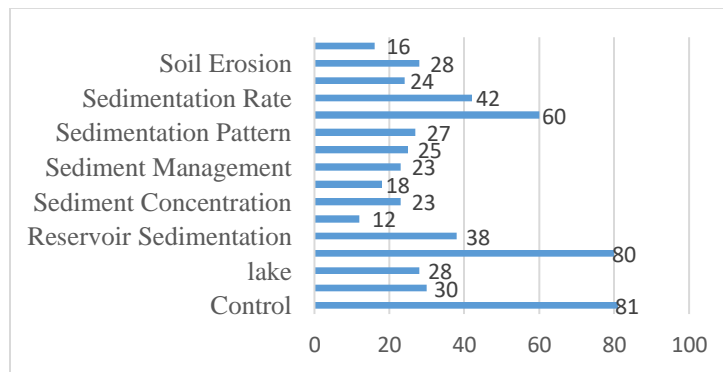


Figure 1. Network Visualization Diagram

The network visualization diagram shows three main discussions (Figure 1): the research object, the reservoir and dam, the sedimentation process, and the action to control the sedimentation. The sedimentation process and control are closely linked to the reservoir and dam with great emphasis, as they exert a significant influence. The sedimentation rate and soil still hold significance, with numerous connections between these keywords, although the density is lower. Despite having the lowest level of connectivity compared to other keywords, tide remains relevant due to its role as a catalyst for sedimentation, influencing the movement and transportation of soil. The network visualization thus provides a comprehensive overview of the relationships within the keywords.



Graph 1. Keywords Based on Occurrences

The network diagram, as depicted in (Graph 1), offers comprehensive data on the total occurrences for each keyword. Notably, the graph reveals that “reservoir” and “control” are the most frequently utilized keywords. However, it is essential to acknowledge that the keyword

“reservoir” lacks relevance within the context of this paper, as it is not a subject of discussion. In contrast, the sedimentation process takes center stage as the background theme of this writing. The remaining keywords exhibit variability among themselves, illustrating their interconnected nature and continued relevance to each other. Other than reservoir, lake, and dam, the rest are related to this article’s main keyword.

Research Keyword Density

VOS Viewer facilitated the visualization of density as an additional outcome. The density visualization concisely summarises the primary domains within a bibliometric network. It provides a clear and accessible method to measure the thickness of connections associated with their keyword of interest. It is a concise and informative representation of the frequency of keywords in scientific literature. It displays three density visualizations that can be examined: link weight, total link strength, and occurrences.

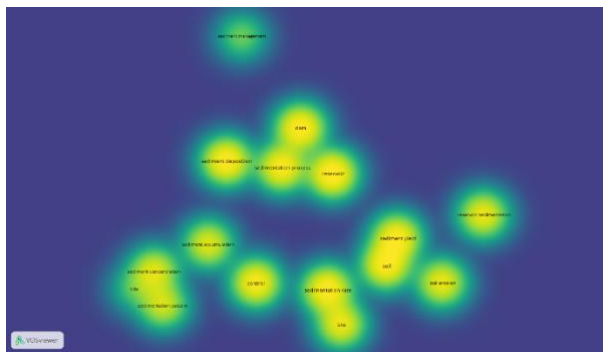


Figure 2. Density Visualization Diagram (Weight by Link)

Density visualization by link wight (3) reveals that tide and sedimentation management exhibit lower density than other keywords. Tide and sedimentation management are still related and relevant to the different keywords. Nevertheless, it is essential to note that tide and sedimentation management maintain relevance and connections with different keywords, emphasizing their continued significance within the broader context. In contrast, density visualization by total link strength (figure 4) indicates that reservoir, dam, and control have the highest number of connections compared to other keywords.

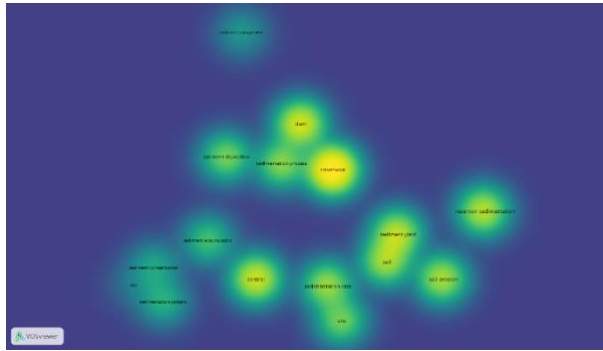


Figure 3. Density Visualization Diagram (Weight by Total Link Strength)

The density visualization based on occurrences (Figure 2) reveals a meaningful pattern, indicating that the sedimentation process, reservoir, and control hold a notably higher density than others. This notable observation suggests a strong focus on discussions about the sedimentation process in the study's water supply structures. The increased concentration in these areas underscores the critical importance of understanding the sedimentation process and the strategies to control it. This emphasis on sedimentation and control highlights their importance in addressing and comprehending the broader issue, emphasizing the interconnected nature of these critical components in water supply structures.

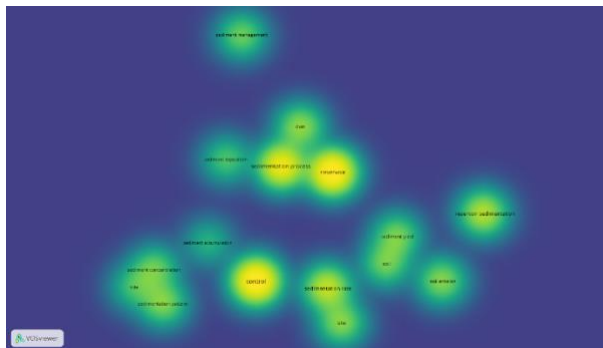
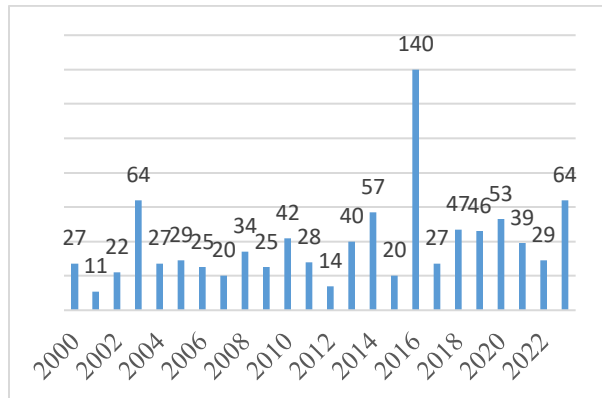


Figure 2. Density Visualization Diagram (Weight by Occurrences)

Research Keyword Per Annum

Analyzing the total number of research published annually is a quantitative metric that is an essential indicator of overall research output. The graph of cumulative research publications per annum can help us understand the trend. It also illustrates the relevance of the topic in each respective year. This visual examination allows for a nuanced understanding of the fluctuations or developments in research productivity, providing valuable context for making strategic decisions. This analytical approach to annual research publication data contributes significantly to the broader comprehension of the dynamic nature of scholarly endeavors.

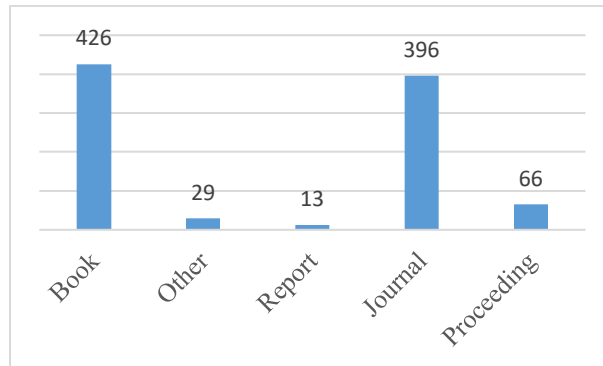


Graph 2. Cumulative Research Data from Various Years

The diagram of cumulative research data from various years consists of 894 data that have been sorted from 2000 to 2023 (**Error! Reference source not found.**). This data reflects a balanced movement from 2004-20012 and 2017-2022. However, there was a fluctuation in 2004; the highest peak occurred in 2016. Meanwhile, the lowest number of publications was recorded in 2001. The interest in researching sedimentation is relatively low. Even so, research on sedimentation remains relevant to discuss by prioritizing innovations in dealing with the problem.

Research Keyword by Type

The consideration of research publications by their types holds significant importance in bibliometric analysis for several reasons. It facilitates the classification and distinction of academic work, assisting in recognizing the various methods of sharing knowledge within a particular discipline. Analyzing the distribution of publication types provides valuable information about the academic environment, showcasing the frequency of different scholarly communication channels. This information is crucial for assessing each publication type’s impact and scholarly influence. Furthermore, the examination of publication types aids researchers and policymakers in assessing the availability and extent of research findings, as various types of publications target specific audiences. Finally, this subtle classification allows researchers to customize their methods of spreading information, guaranteeing that they align with the standards and expectations of particular publications. This, in turn, enhances their research’s overall effectiveness and influence within the academic community.



Graph 1. Classification of Research Types

The graph illustrates the classification of research types in the refined dataset, including four main categories: books, reports, journals, and proceedings (Graph 1). Books and journals are the main contributors and have a significant impact compared to other types of publications. Examining research categories reveals a predominant inclination towards conveying information through books, highlighting the importance of this medium. Furthermore, the equal treatment of journals and books in discussing the topic indicates that they have a similar function as sources of information. This equilibrium represents a state with an equal and fair interest in discussing sedimentation without favoring any particular mode of scholarly communication.

Research Keyword by Publisher and Publication Source

Due to various considerations, analyzing research publications based on their publisher and publication source is essential in bibliometric analysis. Each publisher and source provides valuable information about the credibility and reputation, affecting the scholarly excellence of the research output. Various publishers use different editorial standards and peer-review processes, impacting the published work's rigor and reliability. A thorough analysis of the publication source allows researchers to place the research within particular journals or academic platforms, making it easier to evaluate its influence and prominence within the scholarly community. Examining the publisher and publication source improves bibliometric analyses, leading to a more detailed understanding of the complex research landscape and enabling researchers to make well-informed choices.

Table 1. Distribution Data of Research Publishers

Publisher	Total
American Society of Civil Engineers	54
CRC Press	173
Elsevier BV	106
IWA Publishing	22

MDPI AG	29
Springer International Publishing	40
Springer Netherlands	49
University of California Press	25
Wiley	64

The table displays the distribution of research publishers, explicitly highlighting those with more than ten publications (Table 1). The author’s selection focuses on publishers that maintain high standards. This section further elaborates on the previous graph illustrating the categorization of research types. One example is CRC Press, a distinguished publisher specializing in technical publications. However, the remaining publishers are distinguished academic institutions that excel in engineering. This comprehensive elucidation improves our comprehension of the varied characteristics and expertise of publishers in the dataset, offering valuable context to the importance of their contributions.

Table 2. Distribution Data of Research Source

Publication Source	Total
Engineering Geology for Society and Territory - Volume 3	19
Erosion and Sedimentation	14
Geology of the Olduvai Gorge	25
Hydrological Processes	22
International Journal of Sediment Research	25
Reservoir Sedimentation	20
River Sedimentation	103
Sedimentation and Sediment Transport	41
Sedimentation Engineering	36
Water	25
Water Research	21
Water Science and Technology	11

After examining the distribution data table for research sources (Table 2), it is clear that each selected publication source harmonizes perfectly with the designated keywords and the overall topic of discussion. The precise arrangement of elements demonstrates a careful and deliberate selection process, highlighting the significance and logical consistency of the research. The meticulous selection of sources emphasizes the reliability of the study, demonstrating a solid research methodology and a conscious endeavour to rely on authoritative literature. By aligning the research with reliable and relevant information, the study’s findings and conclusions are strengthened and more valid. Selecting reputable publication sources enhances the credibility of

the research, confirming the meticulous effort put into establishing a solid knowledge base for the study.

CONCLUSION

To summarise, the bibliometric analysis reveals that the investigation of references in “Publish and Perish” shows a significant interconnectedness among the keywords in the collected data. The connectivity is demonstrated through the Network Visualisation Diagram and Density Visualization Diagram. The primary utilization of data, mainly consisting of books and journals, originates from highly reputable sources, highlighting a deliberate focus on scholarly rigour and relevance to the specific field of study and the central theme of this paper. Furthermore, although there are only a few references, the temporal trend analysis emphasizes the ongoing significance of sedimentation in dock-related studies. This observation suggests that, although the numerical scope is limited, the ongoing discussion about sedimentation in dock environments remains relevant. This emphasizes the enduring scholarly interest and importance of this thematic field.

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