

Urban Waterfront Planning: characterization of scientific production through bibliometric analysis

Paula Vale de Paula¹, Jorge Manuel Gonçalves²

¹ CiTUA, Instituto Superior Técnico, University of Lisbon, Portugal. paulavaledepaula@tecnico.ulisboa.pt

² CiTUA, Instituto Superior Técnico, University of Lisbon, Portugal. jorgemgoncalves@tecnico.ulisboa.pt

ABSTRACT

Waterfronts hold enormous potential to drive the change that some important territories require considering the multiple challenges they face today. Their past of enormous importance to the urban economy is now matched by their centrality to the changes that need to occur in cities. They are therefore territories that have played different roles over time and whose urban planning has changed. In this context, this study aims to explore and understand scientific production about the urban planning of waterfronts. To this end, the study was conducted using bibliometric analyses. The bibliometric analyses were divided into performance analysis and scientific mapping. The performance analyses show the topicality of the subject, the predominance in terms of countries, institutions, and authors, and terms of field of study and journals. The scientific mapping carried out through co-word analysis allows us to understand the main topics covered in the literature on urban waterfront planning.

Keywords: urban planning, waterfront, bibliometric analysis.

Topic: espacio público y proyecto urbano en la metrópolis contemporánea

1. Introduction

Intimately related to the origins of cities, because of the resource of water itself (Iovino, 2018), waterfront territories have performed different and important functions over time. The construction of ports gave these territories enormous economic importance, related to industry, manufacturing, and maritime transportation (Avni and Teschner, 2019).

However, with changes in the means of production, consumption, and merchant transportation, port areas have gradually reduced in importance, also affecting the role of waterfronts in the urban context (Davidson, 2013). For many years, these territories were in a state of decline and even abandonment.

After a period of decline, cities around the world have once again turned their attention to these territories, aware of their importance to the urban context and seeking to recover them. Urban regeneration projects on waterfronts can be seen in various cities and periods, and are currently a global phenomenon (Brownill, 2013).

Several authors (Brownill, 2013; Shaw, 2001; Schubert, 2011) suggest four phases related to the urban regeneration of waterfronts: a first phase beginning in the 1970s in the United States, whose classic examples are Baltimore and Boston, with the transformation of their abandoned port areas into zones with high standard developments; a second phase beginning in the 1980s, when these projects arrived in Europe and with the classic example of the Docklands in London, strongly related to private investment; a third phase focused on Europe's seaports, whose main examples are Barcelona, Gothenburg, Hamburg, and Amsterdam, and with a more participatory approach and related to urban planning; and a fourth phase, in which the phenomenon becomes global, affecting cities of different sizes and creating a true symbol of the modern city.

Allied to the global phenomenon that has turned its attention to these territories, waterfronts are currently on the front line in the combat against new challenges such as climate change and rising water levels (Vallega, 2001). In addition, they are key territories in the quest for sustainability, circular, green, and blue economy.

In a few words, waterfronts hold enormous potential for drive the change that some important territories require considering the multiple challenges they face today. Their past of enormous importance to the urban economy is now matched by their centrality to the transitions that are necessary to make in cities and metropolitan areas (Taufen & Yocom, 2021).

They are, therefore, urban territories with different roles over time and whose contribution to urban planning has changed according to the needs of change encountered (Stevens, 2021). Its complexity, flexibility, and mutations can be understood as a metaphor for the city, and it was therefore considered appropriate to confirm this conviction based on the relevance that these areas deserve in scientific research.

Based on this, the present study aims to explore the scientific production regarding the urban planning of waterfronts. To this end, the study was carried out through bibliometric analysis. The use of bibliometric analysis is justified by the possibility of analyzing a large number of articles with scientific precision (Donthu et al., 2021).

Based on the proposed objective, the present study also answers the following research questions:

- What are the main contributions in terms of countries, authors, institutions, and journals?
- What are the main topics that can be identified in the scientific production so far?
- Which topics are more current and can still be explored?

The study is divided into four parts, namely: the first part consists of this brief introduction to the topic, the second part presents the methodology used, the third part presents the results of the analyses carried out, and the fourth part presents the conclusions of the study.

2. Research Methodology

The methodology used was based on the study by Donthu et al. (2021), which suggests four steps for the development of bibliometric analysis, as shown in Table 01.

Steps for developing bibliometric analyses	
Step 1	Define the aims and scope of the bibliometric study
Step 2	Choose the techniques for bibliometric analysis
Step 3	Collect the data for bibliometric analysis
Step 4	Run the bibliometric analysis and report the findings

Table 01. Steps for developing bibliometric analyses.
Source: Elaborated by the authors based on Donthu et al. (2021)

The first step was to define the objectives and scope of the study. The scope focused on urban planning articulated with waterfronts, to assess the topics privileged the scientific research carried out in the past and up to the present moment, as well as eventual gaps still to be explored.

Regarding the scope of the study, Donthu et al. (2021) emphasize the importance of a field of study with a wide enough scope to justify the use of bibliometric analysis. The authors refer to a scope of 500 or more articles for bibliometric analyses to be justified. Based on this, the scientific production regarding urban planning of waterfronts presents a sufficient scope for the use of bibliometric analyses.

The second step consists of choosing the techniques for bibliometric analysis. Also according to Donthu et al. (2021), bibliometric analyses can be of two types: performance analyses or scientific mapping. Performance analyses, as the name suggests, analyze the performance, that is, the contributions of certain constituents of a specific scientific field. These include for example publications by years, publications by countries, publications by authors, publications by institutions, publications by area of study, and publications by journals.

Scientific mapping, in turn, examines the relationships, interactions, and connections within a scientific field, and includes citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis.

Regarding the choice of techniques to be used, the authors emphasize the alignment between bibliometric analysis techniques and the objectives to be achieved. This is because some scientific mapping techniques help to understand a specific field of study about the past, while others help to understand the present moment, and finally, some help to understand future projections.

Based on this information, the present study was designed considering some performance analysis techniques capable of characterizing the analyzed sample in terms of publications by years, authors, institutions, areas of study, and journals. For scientific mapping, the study focused on the co-word analysis technique. Co-word analysis assumes that words that frequently appear together have a thematic relationship with each other. Based on this, co-word analysis can identify the main existing and future research topics.

The third step consists of data collection for bibliometric analysis. Data collection should be carried out in such a way that the volume of data is large enough to justify the use of bibliometric analysis and, at the same time, sufficiently focused on the topic to be studied (Donthu et al., 2021). Another relevant issue in the data collection stage is the cleaning of the data found, providing standardization when they are extracted from different databases, as well as eliminating duplicate or erroneous entries.

For data collection, the Scopus search engine was used, where two searches were performed, considering the keywords: urban planning and waterfront; urban planning and riverfront. The searches were also limited to scientific articles in English. The first search (urban planning + waterfront) found 455 articles, while the second search (urban planning + riverfront) found 67 articles. Of the 522 articles found in the two searches, 20 were

duplicated, i.e. they were present in both searches conducted. Excluding the duplicate articles, 502 articles make up the final sample. The data collection is summarized in Table 02.

Search	Keywords	Query	Papers
1	Urban planning + waterfront	(TITLE-ABS-KEY (urban AND planning) AND TITLE-ABS-KEY (waterfront)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))	455
2	Urban planning + riverfront	(TITLE-ABS-KEY (urban AND planning) AND TITLE-ABS-KEY (riverfront)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))	67
Total papers			522
Duplicate papers			20
Unique papers			502

Table 02. Data Collection. Source: Source: Elaborated by the authors.

The fourth step consists of performing the bibliometric analyses and reporting the findings. Regarding the execution of performance analyses, Microsoft Excel and Power Business Intelligence tools were used for data organization and graph development. For the development of the scientific mapping analysis, in turn, the VOSviewer software was used. The findings will be reported in the results and conclusions of the study.

3. Results

As mentioned above, the bibliometric analyses performed are of two types: performance analyses and scientific mapping. The performance analyses include publications by years, publications by countries, publications by authors, publications by institutions, publications by field of study, and publications by journals. Scientific mapping, in turn, focused on co-word analysis.

3.1. Performance Analyses

3.1.1. *Publications by year*

The study considered all the years of publications available in the research. According to Figure 01, it is possible to observe that the first publications on Urban Planning of Waterfronts date back to 1976 and that the number of publications has been growing considerably in recent years, demonstrating the topicality of the topic.

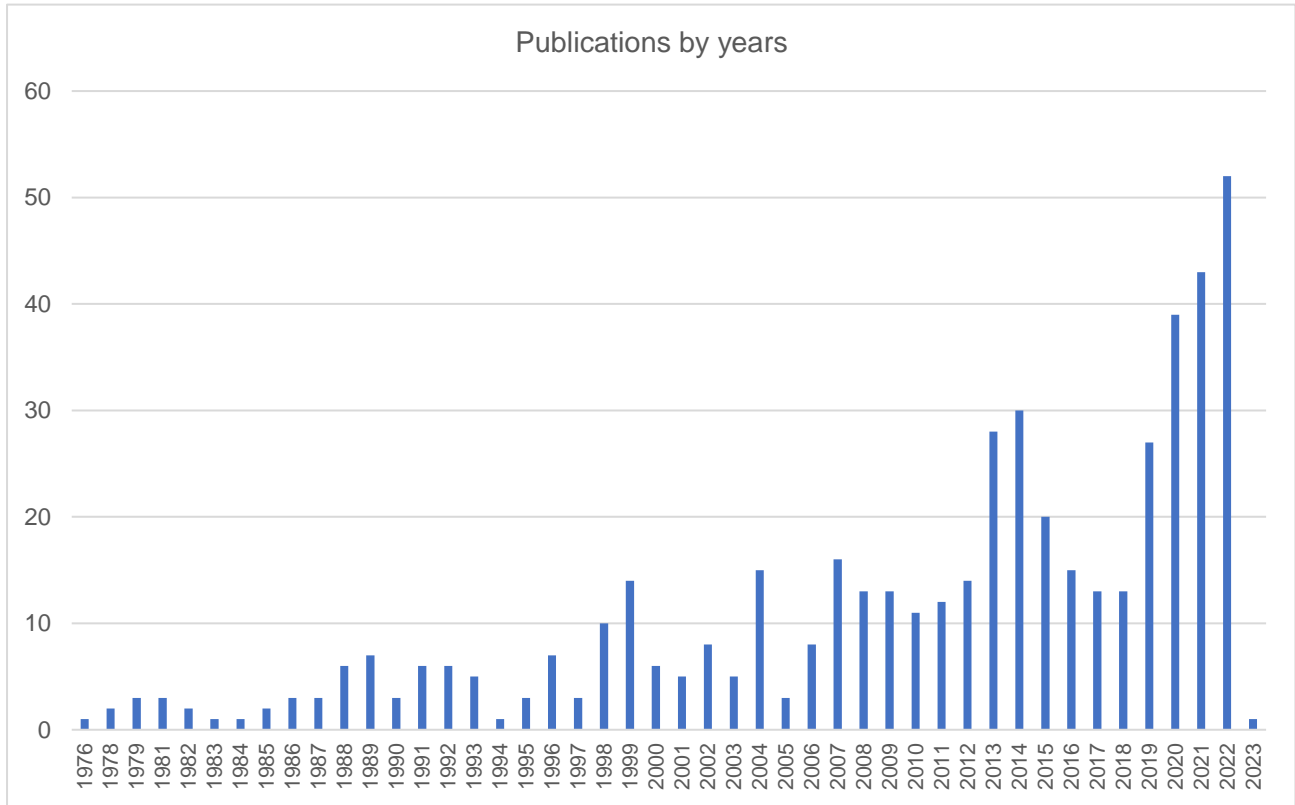


Figure 01. Publications by years. Source: Elaborated by the authors.

3.1.2. Publications by countries

The study considered all countries in the world. It is observed that the United States leads the ranking with the largest number of publications on the topic, followed by China and the United Kingdom (Figure 02). Together, the three countries hold almost 40% of publications. Other countries that stand out are Canada, Australia, Italy, and the Netherlands.

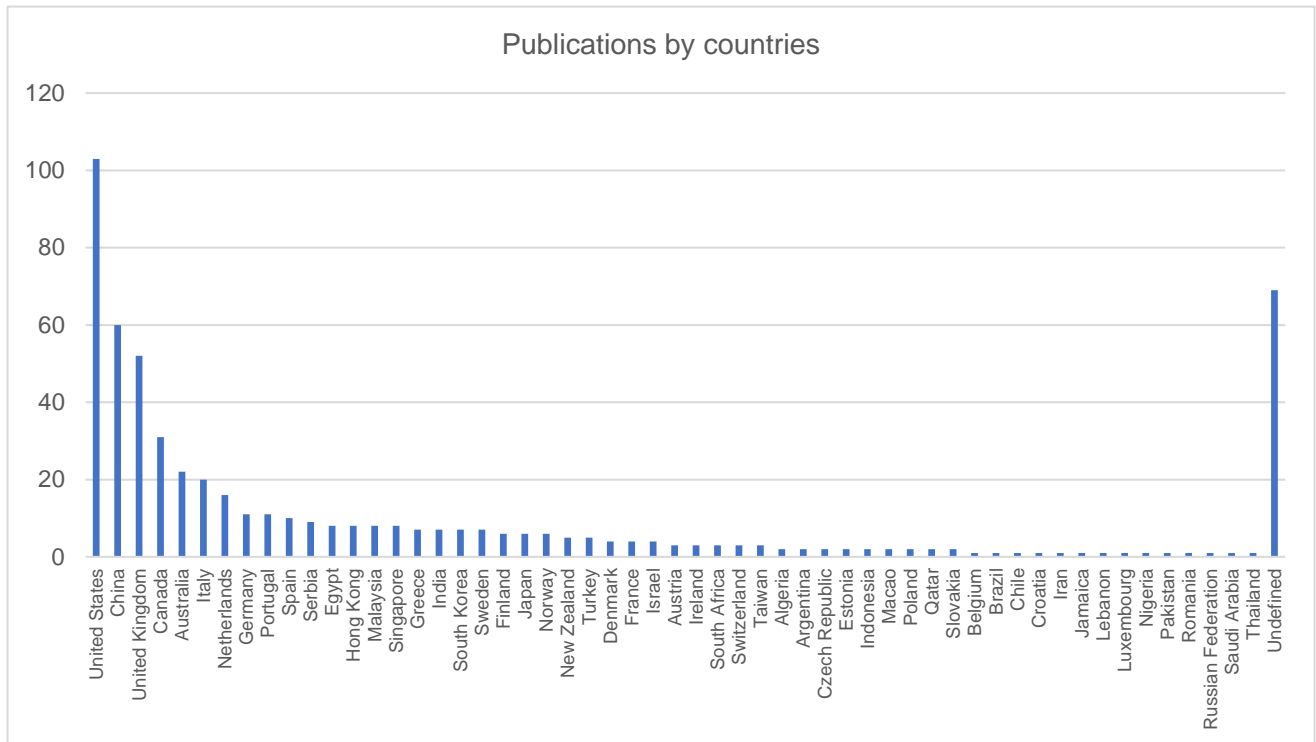


Figure 02. Publications by countries. Source: Elaborated by the authors.

3.1.3. Publications by authors

The study considered all the authors of the articles found. According to Table 03, Hoyle B.S. has the largest number of publications, with 11 publications on the topic, followed by Oakley, S. with seven publications and Desfor, G. with five publications.

Author	Number of papers
Hoyle, B.S.	11
Oakley, S.	7
Desfor, G.	5
Others - four publications	12
Others - three publications	42
Others - two publications	96
Others - one publication	90

Table 03. Publications by authors. Source: Elaborated by the authors.

3.1.4. Publications by institutions

The study considered all authors' institutions. Delft University of Technology has the highest number of publications with 10 publications, followed by the University of Southampton with 9 publications (Table 04). The University of Adelaide, York University and Tongji University each have 7 publications, while the National University of Singapore, Università degli Studi di Napoli Federico II, Simon Fraser University, Wuhan University, University of Lisbon and Faculteit Bouwkunde van de TU Delft have 6 publications each.

Affiliation	Number of papers
Delft University of Technology	10
University of Southampton	9
The University of Adelaide	7
York University	7
Tongji University	7
National University of Singapore	6
Università degli Studi di Napoli Federico II	6
Simon Fraser University	6
Wuhan University	6
Universidade de Lisboa	6
Faculteit Bouwkunde van de TU Delft	6
Others - five publications	15
Others - four publications	44
Others - three publications	63
Others - two publications	124
Others - one publication	52

Table 04. Publications by institutions. Source: Elaborated by the authors.

3.1.5. Publications by study area

Regarding the areas of study, all available areas were considered. Figure 03 shows that publications on Urban Planning of Waterfronts are mainly concentrated in Social Sciences, Environmental Sciences, Engineering, Earth and Planetary Sciences. The four areas together hold almost 80% of the publications analyzed.

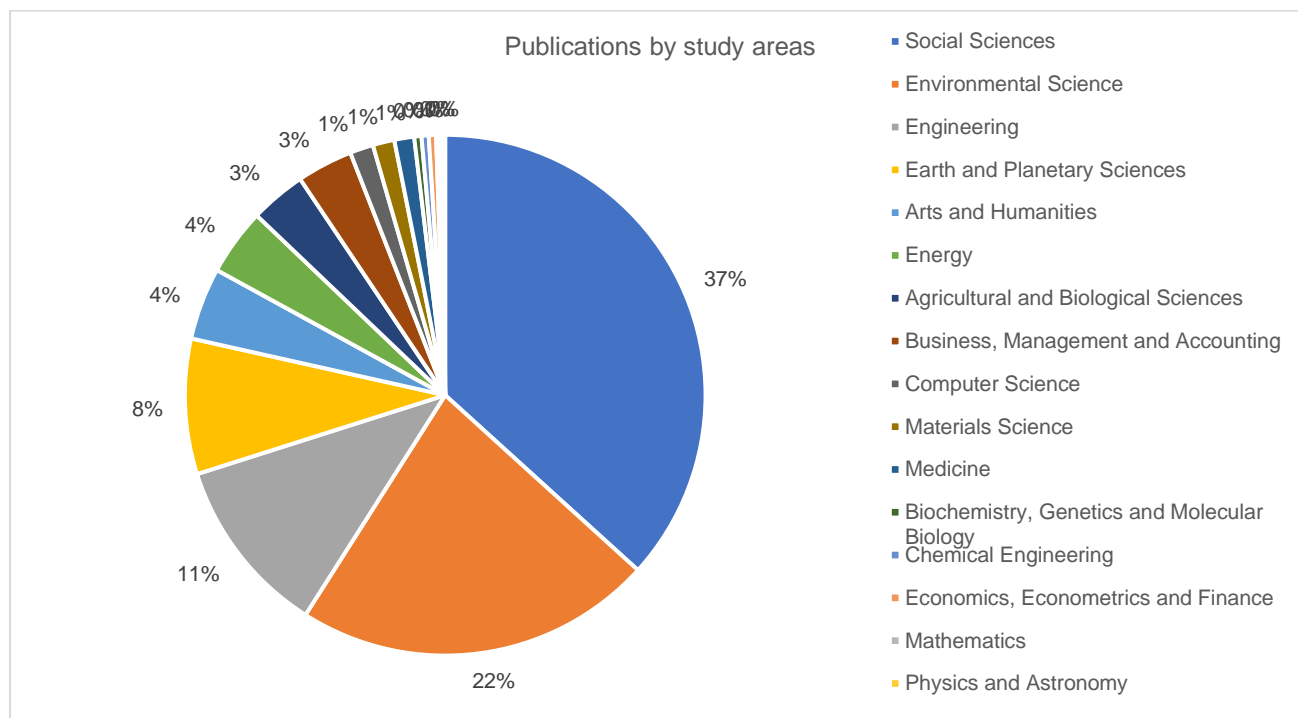


Figure 03. Publications by study areas. Source: Elaborated by the authors.

3.1.6. *Publications by journals*

The study considered all journals that published articles in the sample. According to Table 05, the main journals with publications on the topic are Sustainability Switzerland, with 22 publications, and Planning, with 21 publications. Cities come next, with 19 publications. The journals Journal Of Urban Design, Ocean And Coastal Management and Wit Transactions On Ecology And The Environment, in turn, have 11 publications each.

Journal	Number of papers
Sustainability Switzerland	22
Planning	21
Cities	19
Journal Of Urban Design	11
Ocean And Coastal Management	11
Wit Transactions On Ecology And The Environment	11
International Journal Of Environmental Research And Public Health	9
Urban Planning	8
Journal Of Planning History	7
Others - six publications	36
Others - five publications	10
Others - four publications	48
Others - three publications	48
Others - two publications	54
Others - one publication	81

Table 05. Publications by journals. Source: Elaborated by the authors.

3.2. Scientific Mapping

3.2.1. *Co-word analysis*

The co-word analysis was developed based on all available keywords, i.e. it considered the keywords of the indexes and the keywords of the authors. The first relevant aspect in terms of keywords is the wide variety of words observed. In total, 3,146 different keywords were identified. Considering the frequency of the keywords, it is observed that 2,382 words are cited only once, while 350 words are cited twice and 137 words are cited three times. Figure 04 shows the relationship between the number of keywords and the frequency with which they appear.

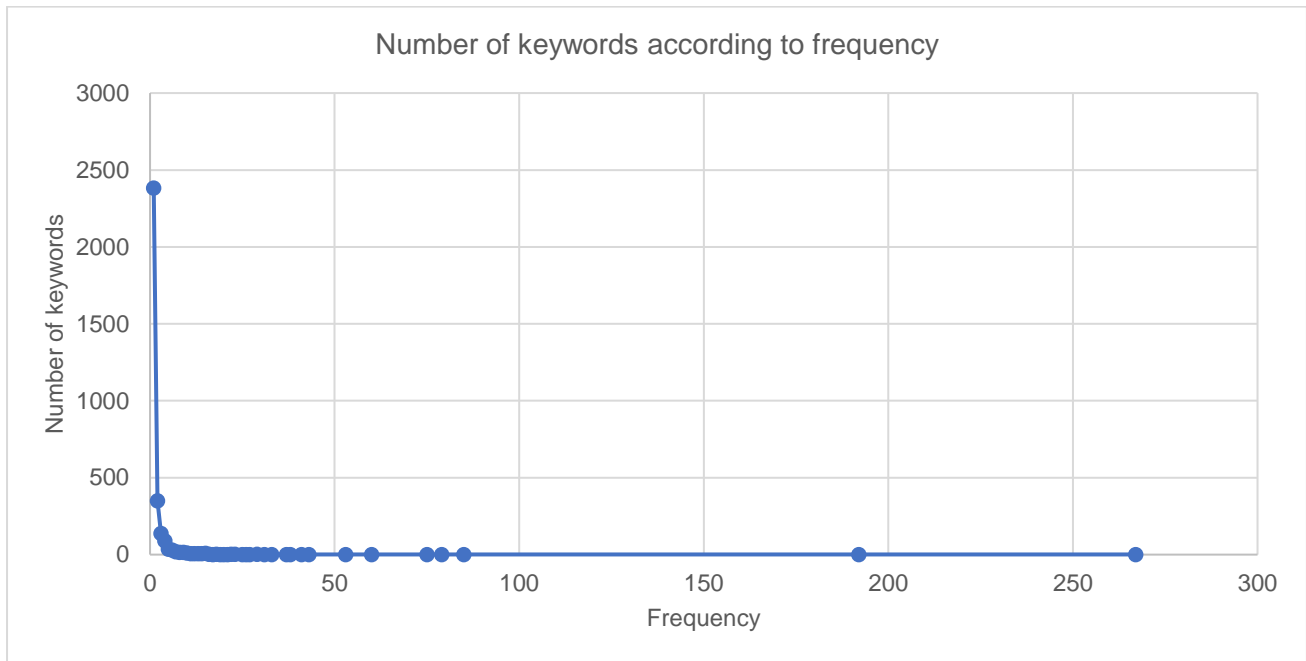


Figure 04. Number of keywords according to frequency. Source: Elaborated by the authors.

Considering the relationship between the number of keywords and the frequency, the co-word analysis carried out in this study included keywords that are repeated in at least 5 documents, resulting in 188 keywords. The choice of a frequency of at least 5 documents was based on the total number of 502 documents analyzed. In other words, keywords that appear in at least 1% of the documents analyzed were considered.

The 188 keywords selected were further worked on in two aspects. The first aspect was the exclusion of some keywords considered not relevant, such as the names of countries or cities. The second aspect was the homogenization of similar keywords, such as "waterfront" and "waterfronts", which were unified so that there are no similar words that can create noise on the map. The result of the co-word analysis can be seen in Figure 05.

In total, the mapping of the words resulted in six clusters. Through the analysis of the keywords of each cluster, it is observed that three clusters relate more to urban planning issues, while the other three relate also to environmental issues. We can identify the clusters as follows:

- Cluster 1 - Dark blue: Addresses topics such as urban planning, public policies, government, and governance.
- Cluster 2 - Light Blue: Addresses planning more closely allied to architecture and public space, also referring to urban history and sense of place.
- Cluster 3 - Purple: Addresses development and especially urban redevelopment, in relation to urban regeneration and tourism.
- Cluster 4 - Green: Addresses the environmental issue, with emphasis on coastal areas, flooding issues and sea level change.
- Cluster 5 - Red: Focuses mainly on water, water quality, and ecosystem services.
- Cluster 6 - Yellow: Focuses mainly on climate and vegetation.

Figure 06 proposes an interpretation of the identified clusters.

redevelopment and urban regeneration; coastal areas; water element and the problem of flooding; green spaces and climate issues. It is also observed that urban planning themes related to environmental issues have been gaining space in the literature.

The concern to align the urban planning of waterfronts with environmental issues demonstrates the importance of these territories in the face of current challenges. While these territories are at the forefront of several current environmental problems, appropriate urban planning of these areas can better respond to the challenges they face. In this sense, this study can point to key issues to be further studied by urban planners.

Despite meeting the proposed objective, the study has limitations. Regarding the methodology used, the study was based on the methodology and techniques proposed by Donthu et al. (2021), without considering other methodologies and techniques that could better suit or even add more information to the work carried out. In addition, limitations regarding the use of VOSviewer software also influenced the quality of the study. In this sense, conducting the same study considering other methodologies and software for analysis may be as interesting as future studies on the topic.

Another limitation refers to data collection since the collection was carried out from a single search engine and through only two searches, also limited to scientific articles and in English. In this sense, future studies may develop bibliometric analyses considering a broader sample of articles through the use of other search engines.

Finally, considering urban waterfronts as territories of change, urban planning allied to these areas should be reviewed and analyzed periodically, since it is constantly evolving. Future studies on the subject can start from the gaps identified here, seeking to understand whether these have been studied further.

5. Acknowledgments

This work was supported by the Portuguese Foundation for Science and Technology (FCT) under the project (1801P.00996.1.01) CiTUA PROGRAM 20-23/UIDP/05703/2020.

6. References

- Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285-296.
- Stevens, Q. (2020). *Activating urban waterfronts: planning and design for inclusive, engaging and adaptable public spaces*. Routledge.
- Taufen, A., & Yocom, K. (2021). Transitions in urban waterfronts: Imagining, contesting, and sustaining the aquatic/terrestrial interface. *Sustainability*, 13(1), 366.
- Avni, N., & Teschner, N. A. (2019). Urban waterfronts: Contemporary streams of planning conflicts. *Journal of Planning Literature*, 34(4), 408-420.
- Brownill, S. (2013). Waterfront regeneration as a global phenomenon. *The Routledge companion to urban regeneration*, 45-55.
- Davidson, M. (2013). *Urban geography: Waterfront development*. University of Western Sydney: Sydney, Australia.
- Iovino, G. (2018). Urban regeneration strategies in water-front areas: An interpretative framework. *Journal of Research and Didactics in Geography*, 1(7), 61-75.
- Vallega, A. (2001). Urban waterfront facing integrated coastal management. *Ocean & Coastal Management*, 44(5-6), 379-410.

Shaw, B. (2001). History at the water's edge. In: Waterfronts in post-industrial cities (pp. 168-180). Taylor & Francis.

Schubert, D. (2011). Seaport Cities: Phases of Spatial Restructuring and Types and Dimensions of Redevelopment. In: Port Cities. Dynamic Landscapes and Global Networks.