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Systematic Review of Port Choice Criteria for Evaluating Port Attractiveness Determinants (PART I): Bibliometric and Content Analyses

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ABSTRACT

The aim of this systematic literature review is to identify the Port Attractiveness Determinants (PADs) and their attributes. These attributes have been extracted from 87 references published between 1970 and 2022. In addition to the conceptual contribution, this review has added value at the methodological and empirical levels. Split in two parts, Part I of this paper presents the findings about the nine PADs identified in the sample screened, which stem from both bibliometric and content analyses performed using software programs and an in-depth screening performed by four reviewers. Part II of this review details the 116 items measuring the PADs.

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1 Introduction

The history and scientific research related to port competitiveness originated in the United States of America. The advent of the Saint Lawrence Seaway Port in 1959 marked the onset of competition among established US ports, including the New York Port [35]. Therefore, we pose the question: «What were the factors that made the Saint Lawrence Seaway Port a competitor during that time?» The answer lies in the port's overall attractiveness. As an initial experience, a port is selected depending on its overall attractiveness. Also, it may be chosen again (or maybe not) based on the last or past experience(s). Hence, the determinants, or drivers, of port attractiveness comprise a set of attributes that users consider while comparing different ports to select the most competitive option. It is important to note that certain users, such as vessels, may choose a port despite their preferences.

To deal with this topic, the present literature review adopts a systematic approach by selecting a period of five decades to identify relevant papers. This period represents the broadest date range studied to date, with the review covering literature from 1970 until the first semester of 2022. Parola et al. [70] conducted one of the most relevant and rare systematic literature reviews (SLR) in the port context. The references cited by the authors cover a period of 32 years, from 1983 to 2014. Furthermore, the current review also incorporates a larger period, encompassing three significant milestones that have marked port and maritime history in terms of (i) governance and institutional restructuring, including port reforms, and (ii) the continuous changes in the international shipping market.

Hereafter, the first part of this paper (Part I) seeks to answer the following questions: «How was the research interested in port attractiveness and port choice?»,

«What are the methods most used by researchers?», «Which fields are most concerned?», «Which is the most perspective studied by researchers?» and empirically, «Which countries and continents are most studied by research?». In addition, we seized the opportunity to explore the attributes (items) to assess the port attractiveness determinants. For this purpose, the Port Attractiveness and Customer Satisfaction Model (PACS Model) is introduced in the second part (Part II) of this paper.

Upon elucidating the adopted methodology (as delineated in *Section 2*), the paper's Part I is structured as follows: Firstly, we present the results of the bibliometric and content analyses of the corpus. Secondly, we provide a discussion on the evaluation of port attractiveness, which is based on the identification of nine determinants (as expounded in *Section 3*). Thirdly, we propose a research agenda for the scientific community that is interested in not only port attractiveness but also port competitiveness and port choice (as described in *Section 4*).

2 Methodology

In order to address the limitations of narrative reviews, this study employs a systematic review methodology, which deviates from traditional reviews by utilizing well-defined and rigorous criteria to identify, appraise, and synthesize the literature, including a list of studies published in peer-reviewed and gray literature [82, 15]. In this regard, the present systematic literature review followed the methodologies outlined in various scientific papers [93, 33, 56, 90, 23, 68, 51]. Furthermore, the freely available e-book entitled *Writing Your Paper*, which can be accessed via the Taylor and Francis' website [80], was also utilized as a resource.

2.1 About the period

Since the 1970s, the maritime and port industries have undergone significant transformations due to the container revolution. Juhel [33] notes that prior to the 1980s, developing countries had a vision of port development that was primarily focused on infrastructure. Consequently, the management of freight flows was neglected in comparison to infrastructure maintenance. Furthermore, the changes imposed by the maritime transport market from the 1980s onwards have favored the development of port strategies [33], leading to a shift in behavior among actors in the shipping industry, particularly in their choice of ports [33, 56]. In 2007, the World Bank introduced the «Landlord Port» model [96] to inspire ports worldwide, marking the beginning of the third milestone in the port industry. Against this backdrop, the present literature review focuses on the period spanning 1970–2022, categorized into three milestones: 1970–1980; 1981–2007; and finally, 2008–2022.

2.2 Keywords

The «snowballing» method [93] was utilized at the outset of this review to determine the keywords for the systematic query. As such, the identified keywords were grouped into two categories using boolean operators. The first group of keywords is composed of «*attractive**», «*competitive**», «*selection*», and «*choice*». These keywords are interconnected with each other by the “OR” operator and then linked by the “AND” operator to the second group, which comprises the following keywords: «*port**», «*seaport**», «*criteri**», «*factor**», and «*determinant**». Similarly, the second group's keywords are joined together by the “OR” operator. The added strings ensure that the search results are relevant. Thus, the strings added to «*attractive**» examine “*attractive*” and “*attractiveness*”, while «*competitive**» examines “*competitive*” and “*competitiveness*”, and «*criteri**» examines “*criteria*” and “*criterion*”. Finally, «*port**», «*seaport**», «*factor**», and «*determinant**» include both singular and plural forms of the keywords. The query was operationalized on the Scopus database, resulting in 157 scientific papers.

2.3 Language

Only papers written in the English language were considered for two primary reasons. Firstly, English is the dominant language in most cited scientific papers [51]. Secondly, 96% of the scientific papers (151 out of 157) obtained through the Scopus query were in English. Moreover, the choice of English as the language of preference aimed to reach scientific papers with a broad international readership, as it targets the widest available audience [23, 5, 93, 68].

2.4 Paper type

In their systematic literature review, Parola et al. [70] concluded that the most pertinent conference papers and book chapters should be incorporated. Consequently, the present study retained the four types of results obtained, namely: «articles», «book chapters», and «conference papers and reviews», with no alterations to the number of papers included.

2.5 Subject area and abstract examination

At this stage, two sub-steps were executed. Firstly, 20 articles were eliminated due to their irrelevance to the research scope (e.g., medicine, biology, physics). Consequently, 131 relevant articles were obtained. Secondly, by scrutinizing the abstracts, 32 articles were excluded for their areas of interest. Ultimately, 99 articles were selected for an in-depth analysis of their contents. These 99 papers, culled from 37 peer-reviewed journals, were classified (Tab. 1) into the three periods delineated in *Section 2.1*.

Table 1 The Scopus-indexed papers (n = 99) were culled from 37 peer-reviewed journals and classified into the three periods delineated in Section 2.1 and the journal ranking index SJR

Journal Title	SJR H-Index ¹	Publication Period			Papers Screened
		1970-1980	1981-2007	2008-2022	
Applied Economics	91	-	1	-	1
Applied Mathematics and Computation	154	-	1	-	1
Applied Soft Computing	156	-	-	1	1
Asian Geographer	10	-	-	1	1
Case Studies on Transport Policy	25	-	-	2	2
Decision Analysis	23	-	-	1	1
Economic Geography	89	1	-	-	1
Energy Policy	234	-	-	1	1
Environment and Planning A	139	-	-	2	2
European Journal of Marketing	110	-	-	1	1
European Transport Research Review	31	-	-	1	1
Growth and change	59	-	-	1	1
Int. Journal of Logistics Management	80	-	-	1	1
Int. Journal of Logistics Systems and Management	32	-	-	1	1
Int. Journal of Shipping and Transport Logistics	25	-	-	2	2
Int. Journal of Supply Chain Management	20	-	-	1	1
Journal of Marine Science and Technology	29	-	1	-	1
Journal of the Transportation Research Forum	5	-	-	1	1
Journal of Transport Geography	118	-	1	1	2
Journal of Transport Economics and Policy	57	1	-	-	1
Marine Policy	104	-	-	2	2
Maritime Business Review	11	-	-	2	2
Maritime Economics and Logistics	55	-	9	8	17
Maritime Policy and Management	61	2	14	8	24
Networks and Spatial Economics	52	-	-	1	1
Ocean and Coastal Management	90	-	-	1	1
Pomorstvo - Scientific Journal of Maritime Research	10	-	-	2	2
Research in Trans. Business and Management	39	-	-	1	1
Research in Transportation Economics	52	-	-	3	3
Transactions of the Royal Instit. of Naval Architects	18	-	-	1	1
Transport Policy	103	-	-	5	5
Transport Reviews	90	-	-	4	4
Transportation	98	-	1	-	1
Transportation Journal	40	1	2	1	4
Transportation Letters	27	-	-	1	1
Transportation Research Part A	142	-	3	1	4
Transportation Research Part E	122	-	1	1	2
Total	-	5	34	60	99

Source: Authors

¹ H-index updated on 2022 by using SCImago Journal Rank platform.

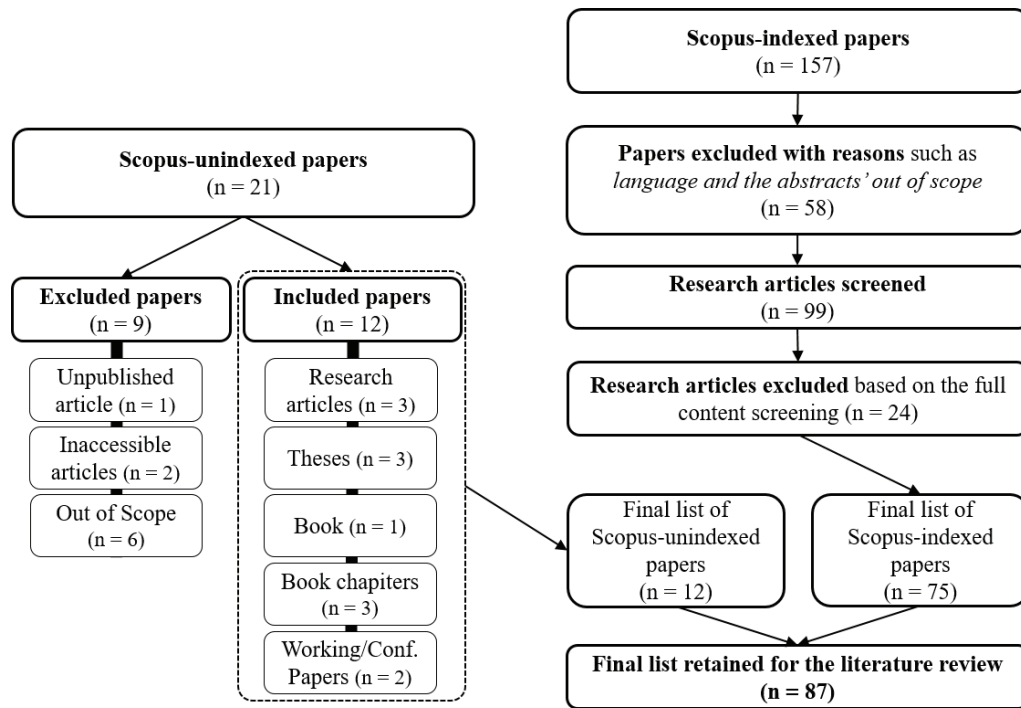


Figure 1 Process summary

Source: Authors

2.6 Full-text examination

After conducting a thorough review of the complete text of the 99 papers, 32 articles were eliminated due to their exclusive focus on a specific area of the maritime and port industries. Nevertheless, owing to their exemplary scientific quality, a few of these omitted articles will be mentioned in the crux of our literature review. Consequently, 75 papers out of the 99 that were amassed in the Scopus database were ultimately preserved.

2.7 Including Scopus-unindexed references to the systematic review

Vieira et al. [90] and Parola et al. [70] identified that the reliance on a limited number of indexed journals and authors is a constraint of the systematic literature review. Hence, it is recommended to incorporate gray literature, theses, books, and scientific papers from unindexed journals into the databases used. In doing so, the biases created by the arbitrary exclusion of certain unindexed works from the systematic literature review are minimized through the integration of relevant contributions.

Subsequently, 21 references that were not indexed in the Scopus database were included in the sample. Consequently, nine papers were excluded for reasons such as paid-access articles or papers that fell outside the review scope. As a result, 12 papers were retained, including three theses, three book chapters, three articles, one book, one conference paper, and one working paper.

It is worth reminding readers that despite the inclusion of additional references, scientific rigor was not compromised. Therefore, the final list of references that will be used to extract the port attractiveness determinants (Part I) and their corresponding items (Part II) amounts to approximately 87 papers.

3 Results

3.1 Paper criteria analysis

An Excel spreadsheet was meticulously prepared, containing the 120 references that were distributed among four reviewers for comprehensive examination. It is important to note, however, that only 117 of these references were accessible and thus subjected to an in-depth screening process. This subset comprised 99 Scopus-indexed papers and 18 Scopus-unindexed papers instead of the initially anticipated 21 papers, which were excluded for the aforementioned reasons.

To facilitate a more versatile data analysis, each scientific paper was methodically classified according to distinct criteria within the same Excel file. This comprehensive approach ensured that the data was organized in a manner that was conducive to effective analysis and interpretation:

- Nine (9) bibliometric criteria: author(s), publication year, type of paper, Google Scholar Citation Number, journal title of the publication, Scimago H-Index (SJR), Editor/Publisher, the paper’s hosting search engine, and the language; and

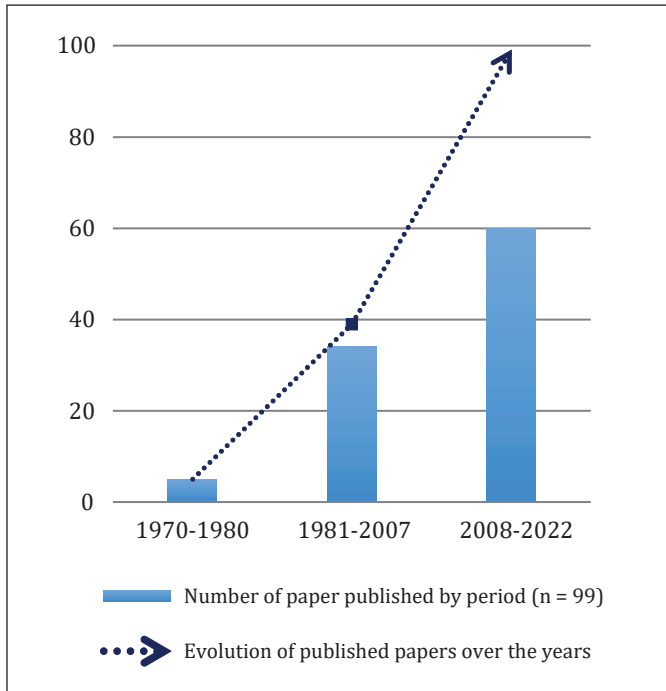


Figure 2 Description of the first selection of the Scopus-indexed papers (n = 99)

Source: Authors

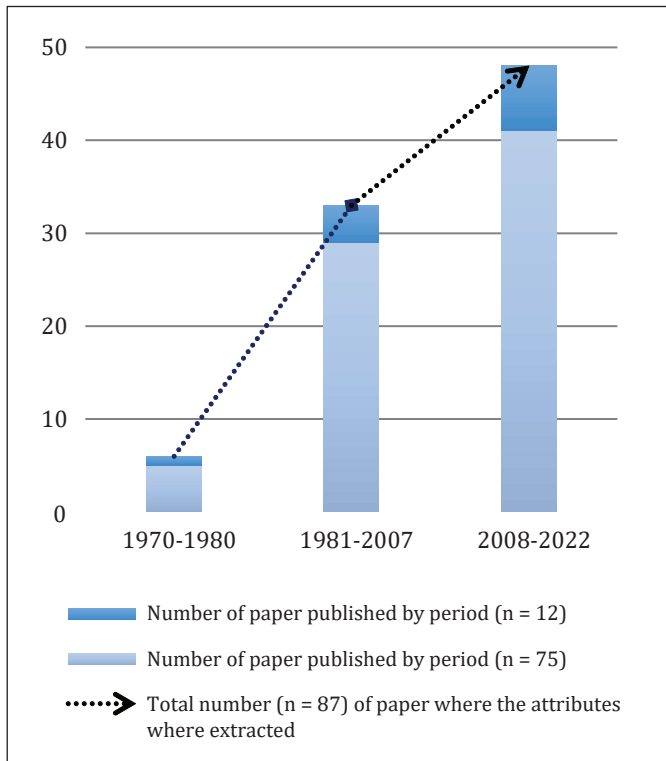


Figure 3 Evolution of the publication in the sample retained (n = 87)

Source: Authors

- Four (4) content criteria: the case studied, which includes 3 sub-criteria [names of the port(s), the country(ies), and the continent(s)], the papers' data sources and/or the studied perspectives, the scientific methods used, and the type of traffic targeted by each paper.

The outputs are shared in the next sub-sections.

3.1.1 Bibliometric analysis

Primarily, the initial selection (n = 99) is scrutinized in detail, utilizing a fixed milestone to illustrate the evolution of research from 1970 to 2022 (Fig. 2). To reiterate, only 75 out of the 99 Scopus-indexed scientific papers were deemed suitable for attribute extraction, in conjunction with the 12 Scopus-unindexed papers (Fig. 3). The volume of literature pertaining to port choice has undergone a noteworthy escalation over the past five decades. A comparative analysis of the Google Scholar citation records was conducted on the sample (n = 87), from which the attributes were derived. It was ascertained that almost 60% of the works had been cited in excess of 50 times (Fig. 4).

The other bibliometric data of the sample (n = 87) are described as follows:

- Paper type: 78 research articles, 3 theses, 3 book chapters, 1 book, 1 conference paper, and 1 working paper;
- Within the entire sample (n = 87), the top five most frequently cited papers are as follows: Notteboom and Rodrigue [65], Tongzon and Heng [85], Slack [76], Tongzon [84], and Lirn et al. [44];
- It is important to note that one article is written in the French language and is on the Scopus-unindexed papers' list; and
- *Maritime Economics and Logistics* from the publisher Palgrave Macmillan Ltd. and *Maritime Policy and Man-*

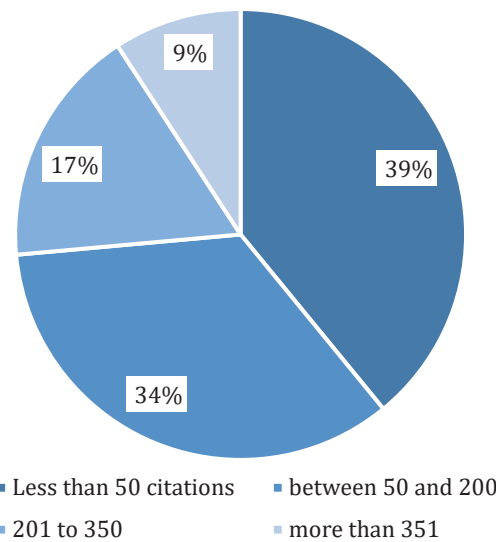


Figure 4 Google Scholar citation number (n = 87)

Source: Authors

agement from the publisher Taylor and Francis Ltd. are the main sources, with a total of 35 research articles (Tab. 2) spread over several years (Fig. 5);

- The majority of the scholarly documents are housed in Scopus, which encompasses prominent publishers such as Elsevier, ScienceDirect, Springer, Springer-

Link, and SpringerOpen. Additionally, six papers are accessible via JSTOR, while one paper can be retrieved through Proquest. The remaining papers are hosted in the online libraries of universities or specialized bookstores, such as the Wiley Online Library's platform.

Table 2 The Scopus indexed and unindexed journal/paper

Journal Title	SJR H-Index ²	Number of Papers
Applied Economics	91	1
Applied Mathematics and Computation	154	1
Asian Geographer	10	1
Case Studies on Transport Policy	25	2
Decision Analysis	23	1
Economic Geography	89	1
Energy Policy	234	1
European Journal of Marketing	110	1
European Transport Research Review	31	1
Growth and Change	59	1
International Journal of Logistics Management	80	1
International Journal of Logistics Systems and Management	32	1
Journal of Marine Science and Technology	29	1
Journal of Navigation and Port Research	n.a	1
Journal of Shipping and Trade	n.a	1
Journal of the Transportation Research Forum	5	1
Journal of Transport Economics and Policy	57	1
Journal of Transport Geography	118	1
Marine Policy	104	1
Maritime Business Review	11	2
Maritime Container Port Security (Book chapter)	n.a	1
Maritime Economics and Logistics	55	14
Maritime Policy and Management	61	21
Thesis	n.a	3
Elements of Port Operation and Management (Book)	n.a	1
Networks and Spatial Economics	52	1
Policy Research Working Paper (World Bank)	n.a	1
Pomorstvo - Scientific Journal of Maritime Research	10	2
Research in Transportation Business and Management	39	1
Research in Transportation Economics	52	1
Revue Organisations & Territoires	n.a	1
SHS Web of conferences GLOBMAR 2018	n.a	1
The Blackwell Companion	n.a	2
Trans. of the Royal Institution of Naval Architects Part A	18	1
Transport Policy	103	2
Transport Reviews	90	2
Transportation	98	1
Transportation Journal	40	4
Transportation Letters	27	1
Transportation Research Part A	142	2
Transportation Research Part E	122	2
Total	-	87

Source: Authors

² H-index updated on 2022 by using SCImago Journal Rank platform.

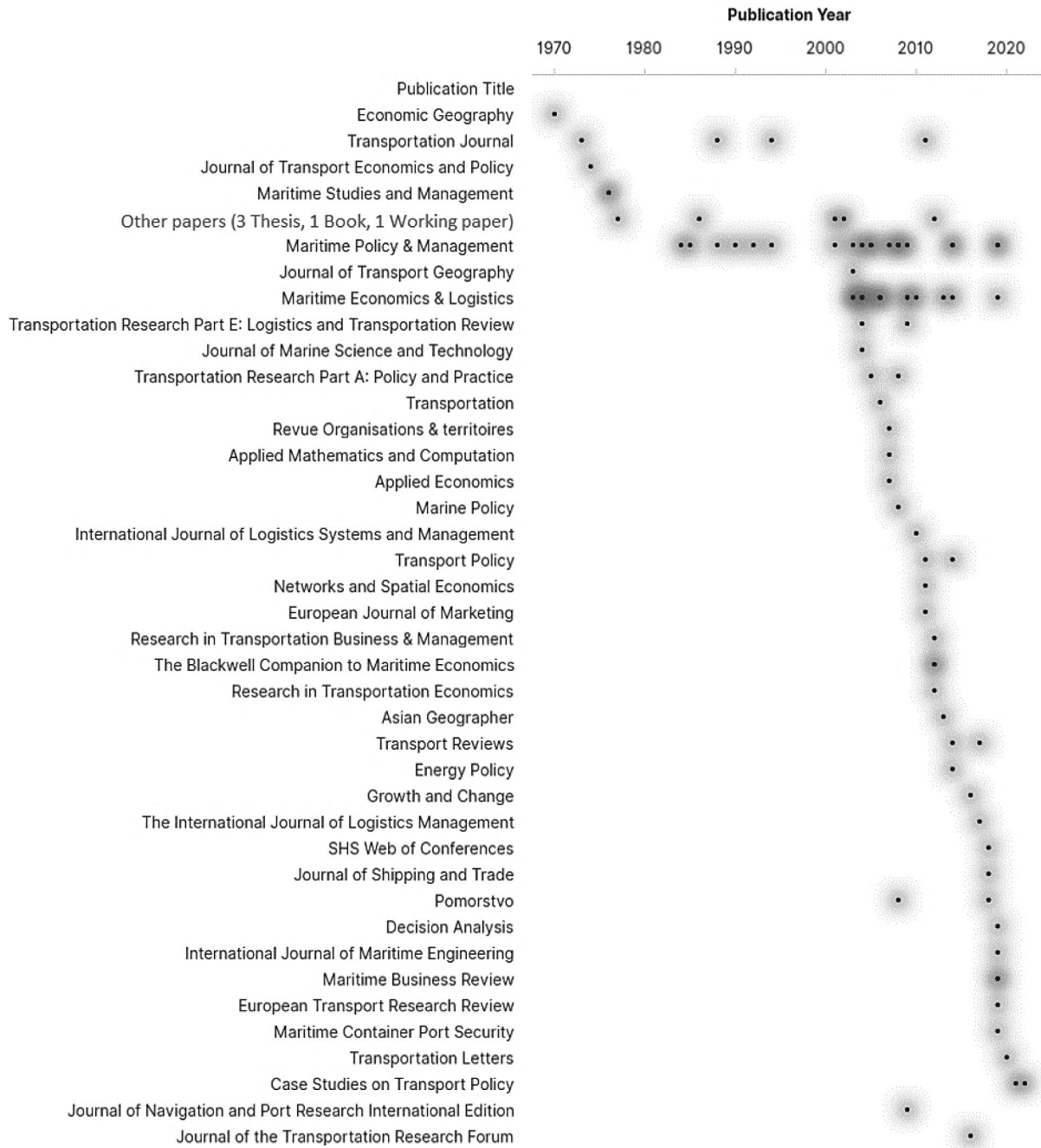


Figure 5 Publication/Journal’s title vs. Year of Publication

Source: Authors using “Scimago Graphica” software

3.1.2 Descriptive analysis

Drawing from our corpus, the selected publications show that 38 papers utilize Asian ports as their case study (44%), while European ports come in second with 25 papers (29%). Ports located in North and South America account for a share of 26%. Despite the presence of strategically significant ports across the African continent, African cases remain significantly understudied, constituting only 7% of the total corpus. The number of studies

conducted on Australian ports remains proportional to the total number of ports on the continent. Finally, 14 studies (16%) do not focus on any particular port.

In terms of countries, Chinese and American ports’ cases continue to be the most commonly studied by researchers, each accounting for 22%. On the European continent, German ports dominate the cases studied (13%), followed by the Netherlands cases (11%), and Belgium’s ports (8%). For the African case, one of the most significant

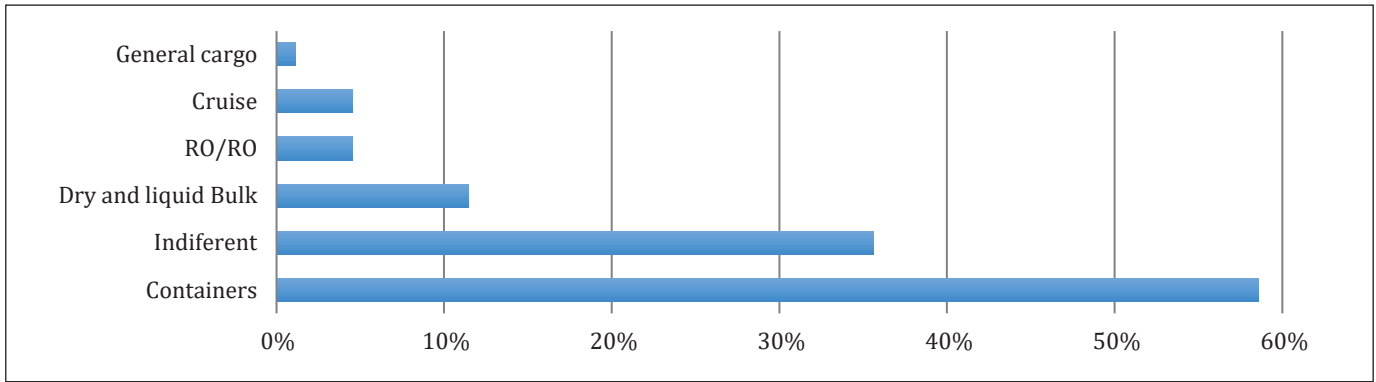


Figure 6 Cargo types most studied (n = 87)

Source: Authors

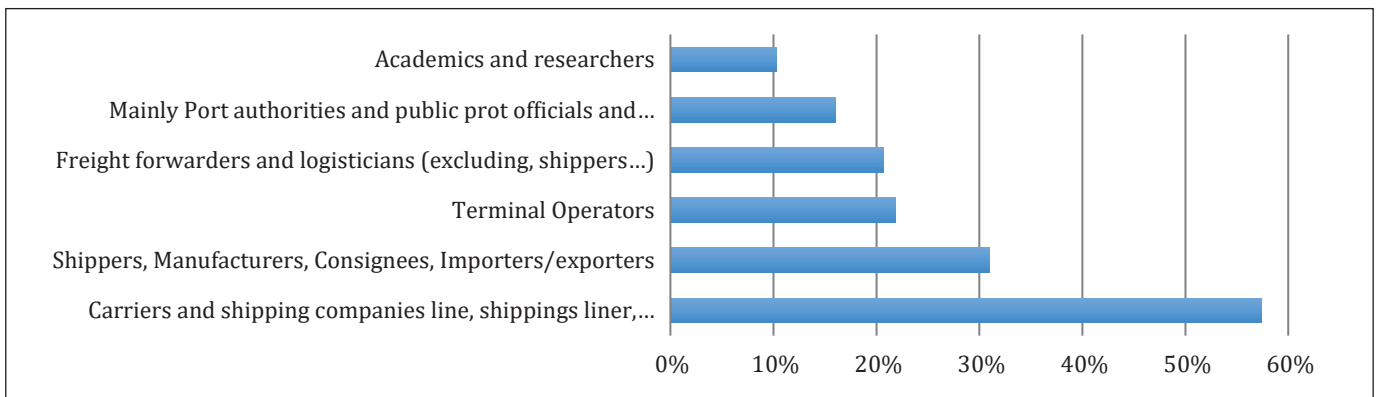


Figure 7 The most perspectives studied (n = 87)

Source: Authors

studies on port attractiveness was conducted in the Nigerian context.

Regarding the most commonly used methods, multi-criteria (or multi-attribute) decision methods (MCDM or MADM) take the lead, with the analytic hierarchy process method (AHP) being employed in 12 papers. The group of studies utilizing statistical methods comes in second with 15 papers. The last group, titled “other methods”, primarily includes papers that employ economic models (five papers), the multinomial choice model (MCM) (four papers), and the discrete choice model (DCM) (three papers).

Furthermore, container activity is the most extensively studied field (Fig. 6), while 36% of the corpus does not specify a particular traffic. Similarly, shipping agents and maritime companies are the most prominent subjects of research (Fig. 7).

3.2 Manual and automated content analysis

During the course of this study, two distinct modes of analysis were employed. The first utilized an automated

approach, facilitated by the “VOSviewer” software, and focused primarily (i) on analyzing the authors of the sample and (ii) on conducting a thorough textual analysis of all abstracts and titles. To prepare the data, all papers were imported into the “Zotero” software. This operation was carried out to export a “.RIS” file type, which is a prerequisite for the “VOSviewer 1.6.18” software. The second mode of analysis was conducted manually, involving a comprehensive examination of the sample (n = 87) to extract the port attractiveness attributes (items), which are presented in detail in Part II of this study.

3.2.1 The automated analysis method: authors, abstracts, and titles

In the sample of this literature review, the interconnections among authors are minimal. Only 19 authors (out of 178) are linked to each other, while the remainder have no research affiliation. This dispersion reinforces the scientific rigor of this review by drawing upon studies from diverse references without being influenced by a particular author’s ideologies. Several clusters of re-

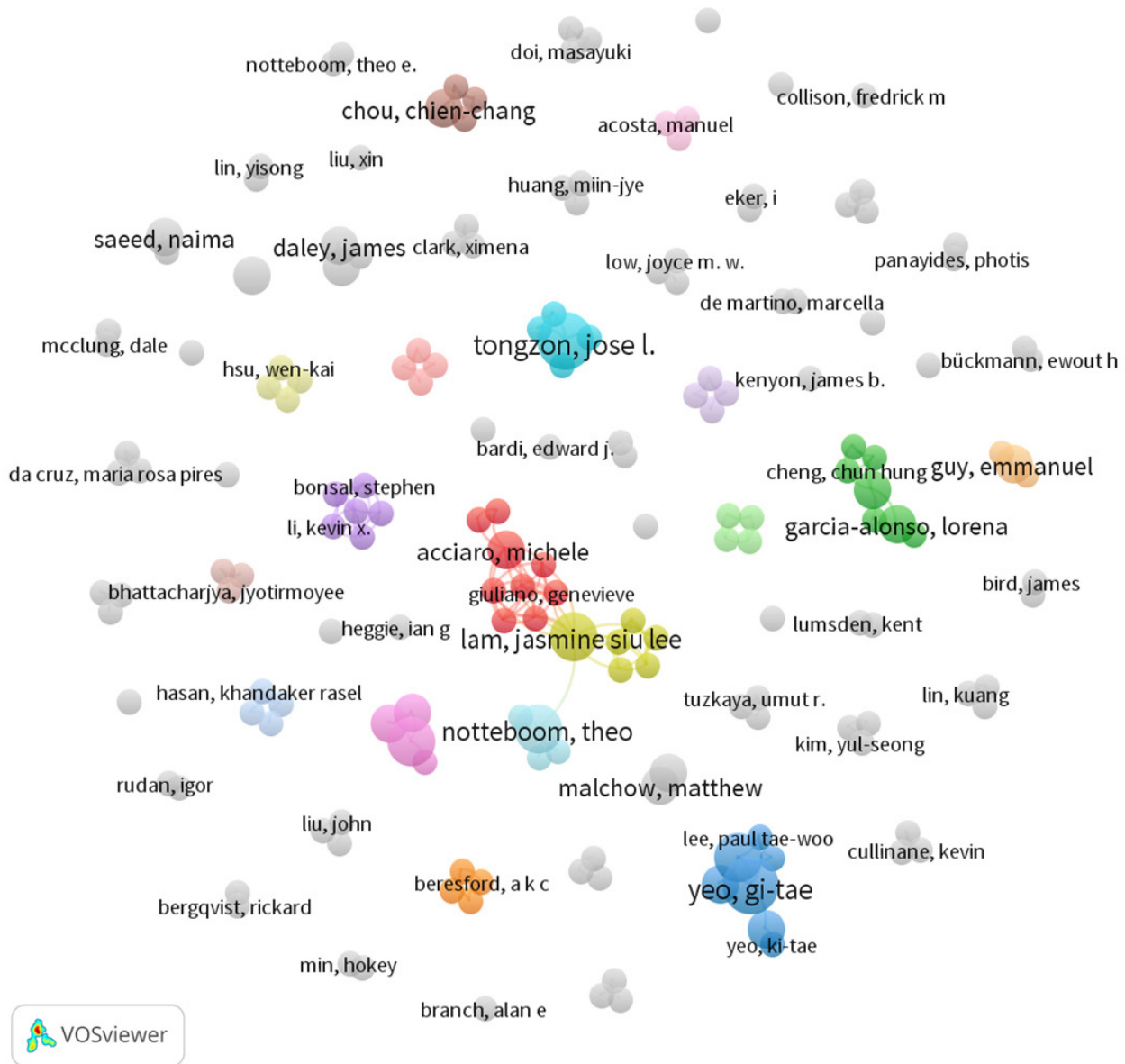


Figure 8 The sources' dispersion and authors' clusters

Source: Authors using "VOSviewer" software

searchers have been observed (Fig. 8). The same analysis was conducted to compare the 99 screened and 75 Scopus-indexed papers. The results were found to be similar to the sample ($n = 87$). For the textual analysis of the papers' abstracts and titles, "port attractiveness" and port

"performance" are relatively new concepts that have been studied recently (Fig. 9). This attests to the novelty of the topic, particularly when comparing the concepts' weight of "competitiveness" versus "attractiveness" (Fig. 10).

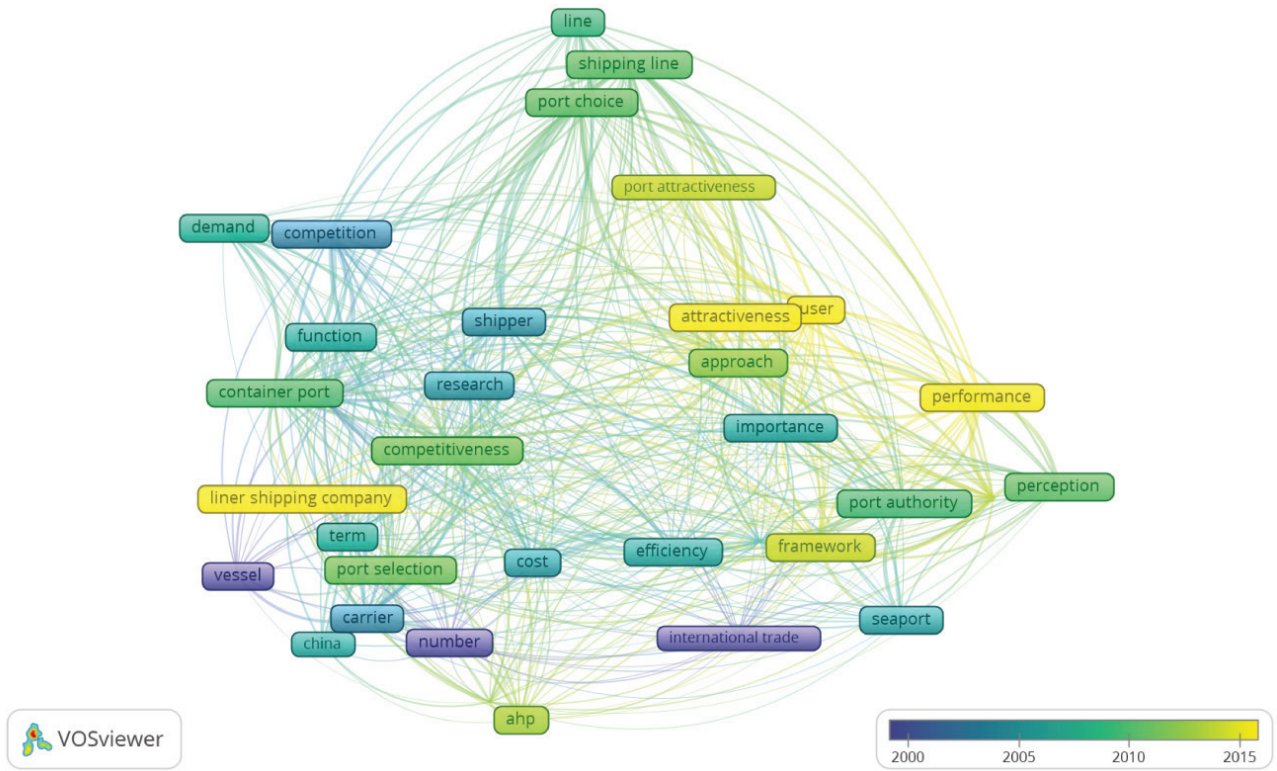


Figure 9 Occurrences most frequently cited in titles and abstracts³

Source: Authors using “VOSviewer” software

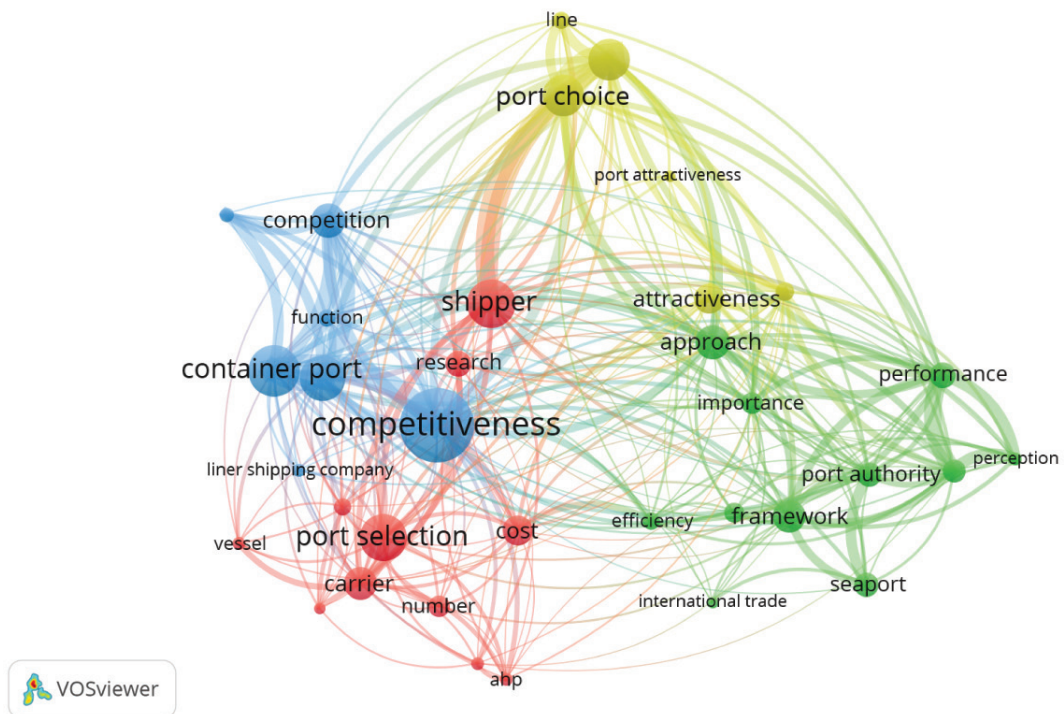


Figure 10 Weight of items based on the analysis of abstracts and titles ($n = 87$)

Source: Authors using “VOSviewer” software

³ Note that the “VOSviewer” software suggested the time period (2000–2015) because of its relevance.

3.2.2 The manual analysis method: deep learning and examination of the contents

As a reminder, the manual approach entails a comprehensive screening of papers by four reviewers. The purpose of this approach is to comprehend the diverse semantics involved and to classify the attributes (items) into the nine related Port Attractiveness Determinants (PADs), which are: “Port Location” and “Port External Environment” [20], “Port Governance” [40], complemented

by the set of PADs proposed by Munim et al. [55]: “Port Costs”, “Green Port Management”, “Port Facilities”, “Port Policy and Management”, “Port Connectivity” and “Port Service Quality”. Prior to discussing the results (*Section 4*), a table that crosses the references (1970–2022) and the determinants of port attractiveness is presented (Tab. 3). Each checked box corresponds to one or more attributes of the related dimension studied by the corpus’ authors.

Table 3 Port Attractiveness Determinants (PADs) based on 87 papers published between 1970 and 2022

Year	Author(s)	Port Attractiveness Determinants								
		Port Location	Port Connectivity	Port Facilities	Port Costs	Port Service Quality	Port Policy and Management	Green Port Management	Port External Environment	Port Governance
1970	Kenyon [35]	√	√	√	√	√	√		√	
1973	Bardi [6]	√		√	√	√	√			
1974	Heggie [31]				√					
1976a	Griffiths [25]			√	√					
1976b	Griffiths [26]	√	√	√	√	√	√			
1977	Riendeau [71]	√	√		√					
1984	Collison [14]	√	√	√	√	√	√			
1985	Slack [76]	√	√	√	√	√	√			
1986	Branch [9]	√	√	√	√	√	√	√	√	
1988	Murphy et al. [59]		√	√		√				
1988	Bird & Bland [8]		√		√	√			√	√
1990	Marti [50]	√	√			√			√	
1992	D’este & Meyrick [17]	√	√	√	√	√	√			
1994	Murphy & Daley [58]			√	√	√	√			
1994	McCalla [52]	√	√	√		√			√	
2001	Malchow [46]	√	√	√	√	√	√		√	
2001	Malchow & Kanafani [47]	√	√		√					
2002	Clark et al. [13]			√	√	√	√		√	
2003	Tiwari et al. [83]	√	√	√	√	√				
2003	Ha [29]	√	√	√	√	√	√			
2003	Veldman & Bückmann [89]	√	√		√	√				
2003	Nir et al. [64]	√	√		√					
2004	Lirn et al. [44]	√	√	√	√	√	√		√	
2004	Malchow & Kanafani [48]	√	√		√	√				
2004	Wood [95]	√	√	√		√	√		√	
2004	Song & Yeo [77]		√	√		√			√	
2004	Teng et al. [81]	√		√	√	√	√		√	
2004	Langen [42]	√					√			√
2005	Cullinane et al. [16]	√	√	√	√	√	√		√	
2005	Notteboom & Rodrigue [65]	√	√	√	√		√	√		√
2005	Tongzon & Heng [85]	√	√	√	√	√			√	
2006	Guy & Hurli [28]	√	√	√	√	√			√	

Year	Author(s)	Port Attractiveness Determinants								
		Port Location	Port Connectivity	Port Facilities	Port Costs	Port Service Quality	Port Policy and Management	Green Port Management	Port External Environment	Port Governance
2006b	(Adolf) Ng [63]	√		√	√	√	√			
2006	Ugboma et al. [87]	√	√	√	√	√	√			
2006	Yeo and Song [98]		√	√	√	√			√	
2007	Tongzon & Sawant [86]	√	√	√	√	√	√			
2007	Alix & Guy [4]	√	√	√	√	√	√		√	√
2007	Chou [12]	√	√	√	√	√	√			
2007	Acosta et al. [3]	√	√	√					√	√
2008	Chang et al. [11]	√	√	√	√	√	√			
2008	De Martino & Morvillo [19]		√	√		√	√	√	√	√
2008	Yeo et al. [99]	√	√	√	√	√	√		√	
2008	Wiegmans et al. [94]	√	√	√	√	√	√		√	
2008	Kolanović et al. [39]			√		√	√			√
2009	Wu et al. [97]			√						
2009	Tongzon [84]	√	√	√	√	√	√			
2009	Kim et al. [37]	√	√	√	√	√	√		√	
2009	Saeed [74]		√	√	√	√	√			√
2009	Garcia-Alonso & Sanchez-Soriano [24]	√	√							
2010	Ng et al. [60]			√	√		√		√	
2010	Roso & Lumsden [73]		√							
2011	Sanchez et al. [75]	√		√	√	√	√			
2011	Tang et al. [79]		√	√	√	√	√		√	
2011	Yeo et al. [100]	√	√	√	√	√	√		√	
2011	Onut et al. [67]	√	√	√	√	√	√		√	
2012	Yuen et al. [102]	√	√	√	√	√	√			
2012	Bergqvist & Egels-Zandén [7]				√			√		
2012	Panayides & Song [69]		√	√	√	√	√			
2012	Notteboom & Yap [66]	√	√	√	√					√
2012	Liu [45]	√	√	√	√	√	√			
2013	da Cruz et al. [72]	√	√	√	√	√	√			
2013	Ng et al. [61]	√	√	√	√	√	√		√	
2013	Kim [36]	√	√	√	√	√	√		√	
2014	Lam & Notteboom [41]				√			√		
2014	Yeo et al. [101]	√	√	√	√	√			√	
2014	Acciaro et al. [1]							√	√	
2014	Acciaro et al. [2]				√			√		
2014	Wang et al. [92]	√		√	√	√		√		
2015	Gohomene et al. [27]	√	√	√	√	√	√		√	
2016	Mittal & McClung [54]		√	√	√	√	√	√	√	√
2017	Parola et al. [70]	√	√	√	√	√	√	√	√	√
2017	Hales et al. [30]	√	√	√	√	√			√	
2018	Kavirathna et al. [34]	√	√	√	√	√	√			
2018	Maerk [49]			√				√	√	√
2018	Sumner & Rudan [78]	√	√	√	√	√	√		√	

Year	Author(s)	Port Attractiveness Determinants								
		Port Location	Port Connectivity	Port Facilities	Port Costs	Port Service Quality	Port Policy and Management	Green Port Management	Port External Environment	Port Governance
2019	Min & Park [53]		√	√	√	√	√			
2019	Ding et al. [20]	√	√	√	√	√	√	√	√	
2019	Vaggelas [88]		√	√	√	√				
2019	Lin & Wang [43]		√	√	√	√	√		√	
2019	Ergin & Eker [22]	√	√	√	√	√	√	√		
2019	Wang & Yeo [91]		√	√	√	√	√			
2019	Lagoudis et al. [40]		√	√	√	√	√			√
2019	Zhang & Roe [103]	√	√	√	√	√	√		√	
2019	De Icaza et al. [18]	√		√	√	√	√	√		
2020	Hsu et al. [32]		√		√	√	√		√	
2021	Kodzi & Saeed [38]	√	√	√			√			
2022	Munim et al. [55]		√	√	√	√	√	√		

Source: Authors

Table 4 Number of items assessing the PADs in the total

PADs	Total number of items	Total number of papers (max = 87)
Port Location	9	58
Port Connectivity	9	68
Port Service Quality	23	68
Port Facilities	26	71
Port Policy and Management	13	57
Port Costs	15	72
Port External Environment	7	39
Green Port Management	7	15
Port Governance	7	13
Total items	116	-

Source: Authors

A total of 116 items were identified to gauge each of the nine PADs. Likewise, Table 4 illustrates the findings through two types of figures: (i) the number of items identified to measure each determinant and (ii) the number of papers investigating each determinant. Further elaboration is provided in Part II of the paper, including a detailed list of the items themselves and their frequency of use by the authors.

4 Discussion

4.1 Port Attractiveness Determinants (PADs)

Ad interim, Part I of this paper concentrates on the nine port attractiveness determinants (PADs) extracted from

the sample. As a reminder, Part II scrutinizes each determinant to exhibit the items that measure them and, consequently, evaluate the port's overall attractiveness.

4.1.1 Port Location (PLoc)

To attract port flows from both the hinterland and foreland sides, port location plays a crucial role. On the one hand, the hinterland side could be characterized by its territorial proximity to the sources of freight, while on the other hand, the foreland side is about the maritime proximity to the main sea routes. Mostly, distance or proximity items, or both, measure port location. Conversely, some studies have employed connectivity items (e.g., "service frequency of liner operations" [77, 98]) to measure port

location. Correspondingly, Wiegmans et al. [94] used a similar item, i.e., “sailing frequency of the deep sea vessels” [94], operated by the above authors to measure port connectivity. *Ceteris paribus*, items measuring port connectivity cannot substitute for port location items. This paper has identified the most frequently cited sub-criterion by researchers, namely “the port’s proximity to the sources of flows” for both goods and passengers. Along the same lines, nine items were identified in 58 papers.

4.1.2 Port Connectivity (PCon)

According to Munim et al. [55] and Yeo et al. [100], port connectivity is a key determinant of port attractiveness. Kim [36] underscores that intermodality is one of the most significant sub-criteria in port selection. This dimension has been measured in several papers by operationalizing various and diverse items. The in-depth review identified nine port connectivity sub-criteria extracted from 68 papers. Therefore, special attention should be paid to intermodality as an attribute.

4.1.3 Port Facilities (PFac)

In reference to “port facilities and equipment”, Rosa Pires da Cruz et al. [72] categorize it as a “physical and technical infrastructure dimension”, which includes “information technology”. In fact, “PFac” is a fundamental component in determining the attractiveness of maritime activity [20, 10]. However, there is some confusion regarding how to measure this determinant. For instance, Song and Yeo [77] contend that the most representative attribute of this dimension is related to port infrastructure such as draft or quay length, storage facilities, and handling equipment. In contrast, Tang et al. [79] support the idea that port depth (also called *port draft*) is an attribute for measuring geographic location. This systematic literature review identified 26 sub-criteria measuring the “port facilities” dimension in 71 papers out of the 87 screened. The basic sub-criteria, such as infrastructure and superstructure, remain the most commonly referenced by authors. Additionally, technological advancements constitute an indispensable sub-criterion in the construction of port attractiveness.

4.1.4 Port Costs (PCos)

According to Slack [76] and Branch [9], “costs” and “fees” are among the determinants of attractiveness. Although the monetary cost is one of the most apparent attributes of port attractiveness. However, there is an interesting counter-thesis based on the case of “ASEAN 4” ports [79]. These ports offer very low port charges, but due to low efficiency and poor port service quality, they fail to attract traffic. The next sub-section discusses this point. For the Port Costs attributes, some appellation-semantic changes have occurred, such as charges, costs, fees, tariffs, prices, fines/penalties/sanctions, and dues. Meanwhile, certain types of costs are not often cited but are

likely to become essential in the future, such as “environmental protection sanctions” and “cost of bunkering”, such as for liquefied natural gas (LNG). In total, 15 sub-criteria (cited in 72 out of 87 papers) have been grouped separately to represent the measurement of port costs.

4.1.5 Port Service Quality (PSQua)

Ng argues that in general, a firm becomes “competitive only when it has a certain level of service quality or attractiveness” [63]. Ha [29] employed the viewpoints of shipping companies from 15 ports to investigate service quality. In Tang et al. [79], the authors deduced that the enhancement of port attractiveness is influenced by the efficacy of its services. Based on Song and Yeo [77], the information systems integrated into a port (such as “cargo traceability”) represent an attribute to evaluate the service level. Finally, this review extracted 23 items from 68 papers to assess port service quality. Two of the most frequently cited measurement items are “time speed in responding vessels” followed by “vessel turnaround time”.

4.1.6 Port Policy and Management (PPMan)

The “PPMan” is a crucial factor in measuring port attractiveness [77, 79]. However, researchers have approached this element differently, and at times, it has been confused with efficiency or service quality attributes (e.g., “Customs Efficiency” [67, 70]). In this review, particular attention was paid to the terminology and lexical semantics employed by the authors when extracting the “PPMan” attributes. The aim was to synthesize the attributes identified in the screened sample as accurately as possible. Consequently, 13 sub-criteria were extracted from 57 papers. The outcome reveals that the most relevant items are “port/terminal reputation”, “port marketing and commercial actions” and “port regulation”.

4.1.7 Green Port Management (GPMan)

Undoubtedly, it is imperative to discuss the environmental impact of port and maritime activities. Branch [9] was among the pioneers to focus on the environmental aspect in the port context. Subsequently, the “GPMan” reemerged in Notteboom and Rodrigue [65] and later in De Martino and Morvillo [19]. Similarly, Acciaro et al. [1] addressed the environmental topic pertinently by emphasizing energy efficiency. Therefore, the “GPMan” is no longer a discretionary option given the current global situation and the emergence of environmental issues. For these reasons, decision-makers are strongly encouraged to adopt new behaviors such as:

- (i) an optimization of energy and the adoption of eco-responsible reflexes;
- (ii) the transition to the new less-polluting energies (e.g., LNG, renewable energies, marine energies);
- (iii) the implementation of CO² capture mechanisms; or for better

(iv) the establishment and application of sanctions related to non-compliance with environmental regulations.

Moreover, the “GPMAN” could serve as a novel dimension to attract partners and investors who embrace eco-friendly strategies [41]. However, there is a dearth of integration of this determinant in academic research on port attractiveness and competitiveness. Fortunately, some scientific publications have recently emerged concerning environmental issues in assessing port attractiveness (see Munim et al. [55]). Following the review, seven items were extracted from 15 papers out of the 87 screened. The most frequently cited items by authors are the implementation of (i) “green projects in ports” and (ii) “national, regional, or global environmental regulations” where the port is situated.

4.1.8 Port External Environment (PEEnv)

Ding et al. [20] assert that “PEEnv” constitutes one of the dimensions that shape port attractiveness. As per several researchers, the “PEEnv” encompasses exogenous attributes that bolster the port’s attractiveness. Consequently, seven sub-criteria attributed to the “PEEnv” were identified in 39 out of 87 screened papers. “Market size” is deemed one of the most pertinent and frequently cited attributes, followed by “social situation and working environment”.

4.1.9 Port Governance (PGov)

During the past two decades, a plethora of academic papers related to port and maritime studies have delved into the topic of port governance, featuring a multitude of theories and models. Similarly, certain researchers posit that “PGov” is a derivative of what was referred to as “PP-Man” in this review, despite the stark contrast between the two fields. “PGov” as a PAD has been identified in Lagoudis et al. [40], which studies the “attractiveness of maritime clusters”. Through screening 87 papers, seven attributes were detected in 39 papers. The ultimate findings indicate that “internal competition level” is the most commonly shared attribute among researchers for measuring “PGov”, followed by “level of trust”.

4.2 Towards new port attractiveness research

4.2.1 About the lack of port attractiveness reviews

Only a handful of academic papers have undertaken a comprehensive review of port choice attributes, as identified in this systematic review based on 32 peer-reviewed journals indexed by Scopus and published between 1970 and 2022. Kim et al. [37] analyzed 11 papers, while Roso and Lumsden [73] highlighted a dearth of research in the corpus of dry ports as a port factor choice. Meanwhile, Parola et al.’s [70] systematic literature review, which scrutinized 46 papers from 25 peer-reviewed journals published between 1983 and 2014, remains the most pertinent.

Moreover, the majority of scientific references screened focus on identifying port attractiveness attributes in a limited empirical context. Despite the need for continuous updating of attributes and determinants due to (i) the rapid and continuous mutations (e.g., changes in port governance); (ii) the emergence of new issues (e.g., environmental and health concerns such as virus circulation, i.e., COVID-19); or (iii) the restructuring of the international maritime transport market resulting from various merger and absorption operations, review papers on port and maritime attractiveness remain scarce.

Therefore, we recommend that reviewers adopt a flexible methodological process, such as the “Scoping Review” method [57], to conduct reviews.

4.2.2 About the port traffic type

Research endeavors in port attractiveness have predominantly centered on container cargo, which constitutes the majority (59%) of studies. However, scant attention has been paid to bulk traffic, with a mere 11% of studies investigating solid and liquid bulk cargo. Nevertheless, containers are far from dominating the world’s maritime trade as a major mode of packaging. In contrast, bulk cargo takes the credit in terms of the tonnage transported. Without a doubt, this dominance is critical to the maritime and port industries’ turnover. Moreover, the evolution of bulk cargo holds greater importance than container flows, both globally and nationally. Future research on port attractiveness should focus on addressing the existing gaps for activities such as bulk cargo and cruise activities.

4.2.3 About the empirical context

On the continental level, the researchers ascertained that 44% of the empirical cases scrutinized pertained to Asian ports, followed by European ports (29%), and finally American ports (26%). At the country level, the most extensively studied cases were ports located in China and the USA, each representing 22%. In Europe, German, Dutch, and Belgian ports accounted for 13%, 11%, and 8% of the cases studied, respectively. Future research endeavors on port attractiveness should prioritize studying the cases of African ports, which have received inadequate attention thus far. Furthermore, given the multitude of freight sources intricately linked to port attractiveness through the port location determinant, the African continent holds immense potential.

4.3 Limitations

This review relied exclusively on papers that were indexed by the Scopus database for the initial selection process, which means that some important papers that are not included in Scopus may have been systematically excluded. Furthermore, one of the limitations of this review is the inclusion and exclusion criteria, which in turn can constitute the most conspicuous bias in any systematic review. To miti-

gate this bias, this paper strived to alleviate it by including Scopus-unindexed papers, such as books, book chapters, theses, and conference and working papers, at the end of the references' systematic selection. However, reviewers should endeavor to explore additional databases, such as those on the Web of Science. Finally, this paper should be periodically updated with contributions from researchers in other empirical contexts (e.g., African ports) or in the study of attractiveness in other types of ports (e.g., dry ports).

5 Conclusion

A port represents a spatially intricate territory with dynamic interrelationships between its foreland and hinterland. As such, studies on port attractiveness are indispensable for examining the key actors' perception of attribute significance and evaluating their degree of contentment. This is precisely where the scientific and managerial intricacy of ports resides. Accordingly, this paper discerns nine port attractiveness determinants (PADs) by scrutinizing 87 papers published between 1970 and 2022. The findings answer the questions earlier announced in the introduction, just to remind: "How was the research interested in port attractiveness and port choice?", "What are the methods most used by researchers?", "Which fields are most concerned?", "Which is the most perspective studied by researchers?" and empirically, "Which countries and continents are most studied by research?". Otherwise, any literature review should have added value [93]. Based on the recommendations of Wee and Banister's article [93], hereafter are the added values of this work:

- (i) A methodological added value: It is manifested by presenting an overview of the methods most used by researchers in the port selection;
- (ii) A state of art of knowledge and gaps in the literature: especially in terms of new determinants to be considered, such as green port management or the genesis of works dealing with port attractiveness. Also, this added value is classified by Wee and Banister [93] as «empirical insights»; and
- (iii) A conceptual added value» by proposing a holistic conceptual framework to be contextualized in any kind of port activity (container, cruise, Ro/Ro, dry and liquid bulk, etc.), whatever the perspective-taking (shippers, shipping lines and agents, port authorities, etc.).

Consistent with these findings, 116 items were identified in the 87 screened papers to assess the nine PADs. Part II of this paper lists and details these attributes.

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