Abstract: In recent years, with the development of society, the awareness of environmental
protection for people has been increasing. While ports promote the economic development and
employment levels of port cities, they also have a negative impact on the environment of port cities.
The sustainability of port cities is increasingly valued. Port cities face huge challenges, and their
sustainability needs to be better understood. The purpose of this article is to review research on the
sustainability of port cities. We used content analysis to classify and analyze the existing relevant
literature, to learn about the hotspots and deficiencies of past research, and to propose future research
directions. We found that port sustainability has become an increasingly important research topic
during the past ten years. From the perspective of geographic research areas, European port cities
are the hot spots for sustainability research. Regarding research fields, technologies, methods and
measures to promote the sustainability of port cities are popular research topics. In terms of research
methods, qualitative research plays an important role in the study of port city sustainability. Finally,
guidance for future research on port city sustainability is proposed according to the review results.

Keywords: port city; sustainability; literature review; content analysis; sustainable development

1. Introduction

With the global population growth and increasingly destructive character of human activities
toward the environment, sustainable development has become a global consensus. The most adopted
definition of sustainability was given in the report of ‘Our Common Future’ for the World Commission
on Environment and Development (WCED) in 1987: “Sustainable development is development that
meets the needs of the present without compromising the ability of future generations to meet their own
needs” [1]. Sustainable development mainly includes three components: environmental sustainability,
economic sustainability and social sustainability. Its connotation emphasizes the coordinated
development of the environment, economy and society, and effectively combines environmental
protection and human development [2–4]. The city itself plays a key role in sustainability, because
it is not only an important engine of economic growth, but also puts tremendous pressure on the
environment while facing huge challenges from society [5]. With the acceleration of urbanization
processes, the population of the city has exploded, and the size of the city has become larger and larger.
The interactions between urban environmental, social and economic issues, and urban sustainability
have attracted increasing attentions [6].

A port city is not only a center of economic activity but also an important hub of the transportation
network. It combines port economy, logistics and industrial activities with the creativity of the local
inhabitants [7]. A port city is usually the gathering point between import and export trade, and between
industry and tourism. In the list of the top ten most powerful cities in the world in 2019, seven are seaport cities [8]. The port and the city are not two separate entities. Instead, the two identities are closely intertwined, and are mutually interdependent and influential [9]. Most coastal cities originated from ports, which support the development of the cities. After the Second World War, the rapid development of international trade led to the development of shipping and manufacturing in coastal areas, resulting in some large ports, which, in turn, created some large cities, such as Tokyo, Los Angeles and Singapore, etc. [10]. Many ports are located near urban centers or residential areas, and have become parts of urban systems [11]. Such a spatial intersection may bring difficulties for the construction of visually appealing urban landscapes, and may result in negative effects on people’s perception of the urban environment [12].

Due to the comparative advantages of economies of scale and network economies which result in low transportation costs, about 90% of world-trade transportation is carried by the international shipping industry [13]. Maritime transportation has significant environmental advantages [14]. The port is a key node of the supply chain and the maritime transportation network [15], and a link between the maritime and land transportation chains [16,17]. Although they have a positive impact on increasing local employment opportunities and promoting local and regional economic growth, port activities impose a great negative impact on environmental pollution and ecological degradation [18,19]. At present, shipping has become one of the fastest growing sectors of greenhouse gas emissions [20]. Approximately 70% of the marine emissions occur in the coastal area around the world, and 60–90% of them occur while ships are berthing in ports [21]. Therefore, the reduction of the time span that a vessel spends in port can reduce emissions [22]. The production and operation activities of ports cause air pollution, noise, soil contamination, habitat destruction, and traffic congestion, etc., causing negative effects on ecosystems and the health of the local communities surrounding the ports [11,23–25]. As a result, there are economic and ecological conflicts between ports and the cities [7,26,27], and ports are facing increasing environmental and social pressure. Ports are closely connected with port cities, and form part of the port–city systems [28]. Due to the great impact of ports on cities, ports have become the key to the sustainable development of the entire urban system. The sustainable development of port cities requires ports to incorporate sustainability into their overall development goals and policies [9].

In recent years, as attention to the sustainability of ports and port cities is increasing, studies focused on port sustainability have gradually increased, and have appeared in some literature reviews [29–32]. As port sustainability is facing new challenges, it is important to update the literature review on the sustainability of port cities. Ports are an important source of pollution, and cities are places where people reside. While relationship between ports and cities is intricate, the sustainability of ports and port cities has increasingly aroused the worry of stakeholders such as port authorities, policy makers, users and local residents. Therefore, a timely literature review is helpful to guide the future development of this field by analyzing the research results on the sustainability of port cities published in relatively influential databases.

2. Methods

2.1. Content Analysis

Content analysis, a highly flexible research method for the analysis of text data, is used to make replicable and valid inferences from data to their context [33]. The framework of content analysis mainly comes from three aspects: the existing theories or practices, the experience or knowledge from experts, and previous research [34]. Content analysis can be converted into two levels of analysis. The first level analysis emphasizes the manifest content of texts and documents by statistical methods. The second level analysis excavates the latent content of texts and documents, explaining the underlying meaning of terms and arguments [35]. Content analysis can be used for both quantitative and qualitative research, and can be divided into quantitative content analysis and qualitative content analysis [34].
Since literature reviews are mainly qualitative syntheses of results, the qualitative content analysis was used in this research [35].

2.2. Qualitative Content Analysis

Qualitative content analysis can be achieved with three main approaches: conventional, directed, and summative. Conventional content analysis starts with observation, and the coding categories are derived from text data; directed content analysis starts with a theory, and the coding categories are derived from theory or relevant research findings; summative content analysis starts with keywords, which are derived from the interest of researchers or a review of the literature [36]. Summative content analysis is not an overall analysis of the data. Usually, the text is treated as it relates to a single word or a specific content. Data analysis starts with searches for the identified words, and calculates the word frequency counts for each identified term. Word counting is used to identify patterns in the data [36]. The process of a literature review is to define and refine parameters and keywords, to search and evaluate the literature repeatedly with keywords in order to evaluate a certain knowledge field, and to discover the knowledge gaps that need to be filled [35]. Therefore, summative content analysis was adopted in this research.

The process of qualitative content analysis can be divided into four steps: material collection, descriptive analysis, category selection, and material evaluation [35]. Subsequently, some researchers use qualitative content analysis in literature reviews to follow the four steps above [37,38]. This approach was used in the literature review in this paper.

3. Implementation Process

3.1. Material Collection

The key to material collection is to delimitate the material and to define the unit of the analysis [35].

3.1.1. Defining Material

1. The type of literature: some conference papers and book chapters may lack peer reviews. In order to better demonstrate the current results of the research topic, we limited the analysis unit to peer-reviewed ‘journal’ articles, and excluded conference papers, book series, book chapters, commercial publications, reviews, reports, government documents, and white papers [30,37].
2. The language of the literature: only materials in English were used.
3. The time frame: because the concept of sustainable development was put forward in 1987, in the report ‘Our Common Future’ in the World Commission on Environment and Development (WCED), articles published between 1987 and 2019 were selected in this study.
4. The database used: Scopus and the Web of Science Core Collection database were used. Scopus is currently the largest abstract and citation database in the world, providing the most comprehensive summary of global research results in the fields of science, technology, medicine, social science, and the arts and humanities, covering over 23,000 peer-reviewed journals (https://www.elsevier.com/?a=69451). The Web of Science Core Collection is among the most trusted scientific research reference indexes in the world, covering more than 250 sciences, social sciences, and arts and humanities disciplines worldwide, bringing together over 21,000 peer-reviewed, high-quality scholarly journals (https://clarivate.com/webofsciencesolutions/web-of-science-core-collection/). The limitation of Scopus is its limited access to publications prior to 1996, but the Web of Science Core Collection can make up for this deficiency [38].
5. The retrieval method: due to the limitation of the title length, some titles may not fully explain the research content of articles, and the abstract can supplement the deficiencies in this regard, so “topic (title, abstract, keywords) retrieval” was used in this study [39].
3.1.2. Defining Unit of Analysis

This analysis consists of three steps: searching for literature with the defined keywords, eliminating the duplicate literature, and quickly checking the abstract and content of the literature in order to determine the final unit of analysis.

The theme of this study is “Port City Sustainability”. In order to achieve the purpose of content analysis, we first needed to collect research on “Port City Sustainability”. In order to improve search efficiency, it is critical to determine keywords that are suitable for database retrieval. The keywords in this study were mainly defined according to our research experience, including those that appeared frequently in the literature of sustainability studies of ports and port cities. Considering that the concepts of “green” and sustainable development are identified as being mutually dependant, the concept of a “green port” is developed from activities for a sustainable port, and is a reflection of a sustainable and environmental friendly port [40], and ecological protection and environmental management are important elements of sustainability [18,26]. After several trial-and-error retrieval attempts, the following keywords were finally determined (Table 1).

| Number | Corresponding Keywords                                           |
|--------|------------------------------------------------------------------|
| 1      | Sustainable port (seaport) city                                  |
| 2      | Port (seaport) city sustainability                               |
| 3      | Green port (seaport) city                                       |
| 4      | Port (seaport) city ecological protection                       |
| 5      | Port (seaport) city environmental management                     |

Using the five keywords listed in Table 1, a total of 528 articles were obtained from the Scopus database. After eliminating duplicate articles, 396 articles remained. Using the same keywords, a total of 448 articles were obtained from the Web of Science Core Collection database. After eliminating duplicate articles, 332 articles were kept (Table 2). We then obtained a total of 728 (396 + 332 = 728) articles from the two databases. Because redundant articles may be stored in the two databases, we eliminated duplicates from the 728 collected articles for the second time, and obtained 514 articles in total. Since this study only focuses on the sustainability issues of port cities related to ports and port industries, after reading and summarizing the abstracts of the 514 pieces of literature, we found that the current research fields related to this research topic were mainly focused on these aspects: the impact of ports’ and cities’ interactions on the sustainability of port cities, a sustainability assessment of port cities, the impact of stakeholders on the sustainability of port cities, and sustainability issues and the solutions of port cities. In order to ensure the reliability and internal validity of the study, after excluding literature for which the topic did not fit the scope of this study, the 61 most relevant pieces of literature were used in this study.

| Keywords/Databases                        | Scopus | Web of Science Core Collection |
|-------------------------------------------|--------|---------------------------------|
| Sustainable port (seaport) city           | 194    | 187                             |
| Port (seaport) city sustainability        | 104    | 112                             |
| Green port (seaport) city                 | 62     | 55                              |
| Port (seaport) city ecological protection | 20     | 14                              |
| Port (seaport) city environmental management | 148    | 80                              |
| Total                                     | 528    | 448                             |
| Duplicate article                         | 132    | 116                             |
| Total after first eliminating duplicates  | 396    | 332                             |
3.2. Descriptive Analysis

The purpose of descriptive analysis is to assess the formal characteristics of the material, and to provide a background for subsequent analysis. This analysis mainly provides basic information about the unit of analysis, such as the distribution of publications over a time period from various source journals [35].

3.2.1. Publishing Time

Among the 61 articles used in the literature review, only one article was published before 2000, and 58 articles were published during the past decade (Figure 1). This may be because, with the understanding of ports and port activities, people have gradually realized that ports are an important source of pollution, and port production and operation activities have caused environmental pollution and ecological damage. In the past ten years, the concept of energy conservation, environmental protection, and sustainable development has become the consensus of global economic development. With the increasing awareness of environmental protection, people are paying more and more attention to the impacts of ports on the environment.

![Number of articles published per year between 1987 and 2019.](image)

Figure 1. Number of articles published per year between 1987 and 2019.

3.2.2. Source Journals

Of the 61 articles, the journal with the most pieces of literature is ‘Sustainability’, which covers 18 articles, followed by ‘Transportation Research Part D: Transport and Environment’, with three articles (Table 3).

| Source Journal          | Articles (Totally Selected 61 Articles)                                                                                                                                                                                                                     | Number of Articles |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Sustainability          | Kourtit and Nijkamp (2013), Fusco Girard (2013), Lam and Yap (2019), Liu et al. (2019), De Rosa and Di Palma (2013), Attardi et al. (2012), Li et al. (2019), van Timmeren et al. (2012), Mrak (2013), Li et al. (2016), Zanetti et al. (2016), Zheng, Wang et al. (2017), Zheng, Yang et al. (2017), Fusco Girard and Nocca (2019), Gravagnuolo et al. (2019), Ito et al. (2019), Lee et al. (2019), Williams (2019) | 18                 |
Table 3. Cont.

| Source Journal                                      | Articles (Totally Selected 61 Articles)                | Number of Articles |
|-----------------------------------------------------|-------------------------------------------------------|--------------------|
| Transportation Research Part D: Transport and Environment | Schipper et al. (2017), Tang et al. (2017), Merico et al. (2019) | 3                  |
| European Journal of Sustainable Development         | Ezzat (2016), Mammadova (2017)                        | 2                  |
| Journal of Cleaner Production                       | Frantzeskaki et al. (2014), Holmstedt et al. (2017)  | 2                  |
| International Journal of Global Environmental Issues | Hein (2014), Ravetz (2014)                            | 2                  |
| Journal of Industrial Ecology                        | Shahrokni et al. (2015), Voskamp et al. (2017)       | 2                  |

3.3. Category Selection and Material Evaluation

Category selection means the selection of the structural dimensions and related analytic categories to apply to the collected material. Material evaluation means the analysis of the material according to dimensions, where abstract, explanatory and structured means are used to understand and explain the text [35]. The research areas, research problems and research methods of articles were selected for classification and analysis in this study [30,31,41].

3.3.1. Geography of Case Studies

Among the 61 articles, 33 of them were published for European port cities, 20 for Asian port cities, nine for American port cities, and five for African port cities. Three articles were related to the port cities of Oceania (Table 4). More than 50% of the areas of the case studies were related to European port cities, which may be due to the significant share of European researchers in the port economics field. The port city that appeared the most was Rotterdam in the Netherlands, which reached nine times; followed by Amsterdam in the Netherlands, which appeared five times; followed by Antwerp in Belgium, Stockholm in Sweden, Shanghai in China, and Hamburg in Germany, which appeared four times each. Los Angeles in the United States (USA), London in the United Kingdom (UK) and Naples in Italy appeared three times. The reason may be that these ports are geographically superior; that they are global port hubs, or historical and cultural ports; and that they are the concern of many researchers.

Table 4. Classification according to the geographical distribution of the port cities in the case studies.

| Port City (Country or Region) | Articles (Totally Selected 61 Articles) | Frequency (%) |
|------------------------------|----------------------------------------|---------------|
| Europe                       | Kourtit and Nijkamp (2013), Voskamp et al. (2017) | 33 (54%)      |
| Amsterdam (Netherlands)      | Meyer et al. (2012), Frantzeskaki et al. (2014), van Tuijl and van den Berg (2016), Dircke and Molenaar (2010), Van Timmeren et al. (2012) | 2             |
| Rotterdam (Netherlands)      | Cavallo et al. (2015), Pugliano et al. (2018), De Rosa and Di Palma (2013) | 5             |
| Naples (Italy)               | Attardi et al. (2012)                   | 3             |
| Brindisi (Italy)             | Merico et al. (2019)                    | 1             |
| Bari (Italy)                 | Sheeran and Pilato (2017)               | 1             |
| Venice (Italy)               | Fusco Girard and Nocca (2019)           | 1             |
| London/Glasgow (UK), Rotterdam/Amsterdam (The Netherlands), Paris/Marseille (France), Antwerp/Brussels (Belgium), Maribor/Lubljana (Slovenia), Praga (Czech Republic), Kalundborg (Denmark), Göteborg/Malmö (Sweden) | 1 |
| Port City (Country or Region)                                                                 | Articles (Totally Selected 61 Articles)                                                                 | Frequency (%) |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------|
| Liverpool, Glasgow (UK)                                                                      | Ravetz (2014)                                                                                            | 1             |
| Amsterdam/Rotterdam (Netherlands), London (UK), Antwerp (Belgium), Hamburg (Germany), Marseille (France), Lisbon/Porto (Portugal) | Gravagnuolo et al. (2019)                                                                           | 1             |
| Copenhagen (Denmark)                                                                         | Karimpour et al. (2019)                                                                                   | 1             |
| Stockholm (Sweden)                                                                           | Williams (2019), Holmstedt et al. (2017), Shahrokni et al. (2015)                                         | 3             |
| Stockholm (Sweden), Amsterdam (Netherlands)                                                 | Bossuyt and Savini (2018)                                                                                | 1             |
| Barcelona (Spain)                                                                            | Ruiz-Guerra et al. (2019)                                                                               | 1             |
| Alicante (Spain)                                                                             | Aragonés et al. (2017)                                                                                   | 1             |
| Piraeus (Greek)                                                                              | Delitheou and Georgakopoulou (2019)                                                                      | 1             |
| Gdynia (Poland)                                                                              | Przybyłowski (2018)                                                                                      | 1             |
| Dublin (Ireland)                                                                             | Tang et al. (2017)                                                                                       | 1             |
| Split (Croatia)                                                                              | Dondović et al. (2013)                                                                                  | 1             |
| Rijeka (Croatia)                                                                             | Mrak (2013)                                                                                            | 1             |
| Antwerp (Belgium), Hamburg (Germany), Rotterdam (Netherlands)                               | Schipper et al. (2017)                                                                                  | 1             |
| Rotterdam (Netherlands), Hamburg (Germany), Antwerp (Belgium)                               | Chen and Lam (2018)                                                                                      | 1             |
| London (UK), Hamburg (Germany)                                                               | Hein (2014)                                                                                            | 1             |
| Barcelona/Palma de Mallorca/Malaga (Spain), Venice/Civitavecchia/Genoa/Naples/Leghorn/Savona/Bari (Italy), Piraeus/Corfu/Santorini/Mykonos/Katakolo (Greece), Marseille (France), Dubrovnik (Croatia), Valletta (Malta) | Rosa-Jiménez et al. (2018)                                                                           | 1             |
| No specified port city (UK)                                                                  | Yigit and Acarkan (2018)                                                                                 | 1             |
| Asia                                                                                         | 20 (33%)                                                                                               |               |
| Singapore (Singapore)                                                                        | Xiao and Lam (2017)                                                                                      | 1             |
| Shanghai (China)                                                                             | Li et al. (2019)                                                                                         | 1             |
| Guangzhou/Shenzhen (China)                                                                   | Lam and Yap (2019)                                                                                       | 1             |
| Dalian et al. (China)                                                                        | Liu et al. (2019)                                                                                        | 1             |
| Ningbo (China)                                                                              | Zheng, Yang et al. (2017), Zheng, Wang et al. (2017)                                                     | 2             |
| Rizhao (China)                                                                               | Wang et al. (2009)                                                                                       | 1             |
| Dalian/Shanghai/Ningbo et al. (China)                                                         | Li et al. (2016)                                                                                         | 1             |
| Istanbul/Kusadasi (* Turkey)                                                                  | Rosa-Jiménez et al. (2018)                                                                               | 1             |
| Tokyo (Japan)                                                                                | Hein (2014)                                                                                            | 1             |
| Kawasaki (Japan)                                                                             | Fusco Girard and Nocca (2019)                                                                            | 1             |
| Kanazawa (Japan)                                                                             | Mammadova (2017)                                                                                        | 1             |
| Kushiro (Japan)                                                                              | Ito et al. (2019)                                                                                        | 1             |
| Incheon (Korea)                                                                              | Lee et al. (2019), Kwon et al. (2019)                                                                    | 2             |
| Jakarta (Indonesia)                                                                           | Younger et al. (2015)                                                                                     | 1             |
| Famagusta (Cyprus)                                                                            | Gurpinar and Balcioglu (2018)                                                                            | 1             |
| Istanbul (Turkey), Shanghai (China), Ho Chi Minh City (Vietnam)                              | Schipper et al. (2017)                                                                                   | 1             |
| Shanghai et al. (China), Singapore (Singapore), Busan (South Korea), Dubai (United Arab Emirates), Klang et al. (Malaysia), Kaohsiung (Taiwan), Laem Chabang (Thailand) | Chen and Lam (2018)                                                                                      | 1             |
3.3.2. Research Focuses

After examining the research focus of each article, we grouped the 61 articles into five research-focus categories (Table 5).

| Port City (Country or Region)          | Articles (Totally Selected 61 Articles)                   | Frequency (%) |
|----------------------------------------|------------------------------------------------------------|---------------|
| America                                |                                                             | 9 (15%)       |
| Los Angeles et al. (USA)               | De Lara (2017)                                             | 1             |
| Los Angeles (USA)                      | Chen and Lam (2018)                                        | 1             |
| Seattle (USA)                          | Wessells (2014)                                            | 1             |
| Philadelphia (USA)                     | Hein (2014)                                                | 1             |
| Halifax et al. (Canada)                | Hoyle (1999)                                               | 1             |
| Rio de Janeiro (Brazil)                | Morel et al. (2013)                                        | 1             |
| Santos (Brazil)                        | Zanetti et al. (2016)                                      | 1             |
| Los Angeles (USA), Valparaiso (Chile)  | Schipper et al. (2017)                                     | 1             |
| No specified port city (Brazil)        | Yigit and Acarkan (2018)                                   | 1             |
| Africa                                 |                                                             | 5 (8%)        |
| Suez Canal et al. (Egypt)              | Ezzat (2016)                                               | 1             |
| Port Said (Egypt)                      | Megaheh (2014)                                             | 1             |
| Elizabeth (South Africa)               | Odindi and Mhangara (2012)                                 | 1             |
| Dar Es Salaam (Tanzania)               | Schipper et al. (2017)                                     | 1             |
| Tunis (The Republic of Tunisia)        | Rosa-Jiménez et al. (2018)                                 | 1             |
| Oceania                                |                                                             | 3 (5%)        |
| Melbourne (Australia)                  | Schipper et al. (2017)                                     | 1             |
| Suva et al. (Fiji)                     | Gravelle and Mimura (2008)                                 | 1             |
| Honiara (Solomon Islands), Port Vila (The Republic of Vanuatu) | Trundle et al. (2019)                                      | 1             |
| No specified country or region         | Fusco Girard (2013), Fusco Girard (2010), Przybylowski (2019), Ignaccolo et al. (2018) | 4 (7%) |

* Note: because most of the territory of Turkey is in Asia, it is classified as an Asian country.

Focus 1: the impact of ports’ and cities’ interactions on the sustainability of port cities

Ports and cities are two different spatial economies, and they are always in a dynamic state of interaction and interdependence. In port–city interactions, the port benefits the city by its role in facilitating trade, employment, economic development, and environmental sustainability, while the port relies on the city to obtain services, including the labour pool and management talent [42]. Considering sustainability, creativity and resilience, ports could become development opportunities for port cities [43]. Protecting the architectural heritage of ports could help improve the quality of life for local residents, and could promote the sustainable social development of port cities [44]. The efficiency of the port would affect the economic development of port cities [45]. The environment and sustainability plans of ports could guide the ecological sustainability of port cities in some ways [46]. The wealth growth for port cities is a balance between ports and cities adapting to shifting needs and opportunities [47]. Xiao and Lam [10] used the system theory to develop a system framework for the sustainable development of port cities, based on economic, social and environmental standards, in order to analyze the relationship between the port and city of Singapore. Liu et al. [48] used a grey relative relational model and a coupling coordination degree model to analyze the degree of interaction and the coordination trends between the comprehensive development levels of port cities.
The analysis of Li et al. [49] showed that the increase in maritime transportation activities promoted urban economic growth to a certain extent, but also brought environmental pollution and waste of resources. It was necessary to adopt energy-saving and emission-reduction measures to realize the green development of ports and cities. The study from Pugliano et al. [50] showed that only through the integration of urban and port planning, and through a balance between public and private interests, could the sustainable development of port cities truly be realized.

Focus 2: the evaluation of the sustainable performance (plans, policies and programs) of port cities.

With the focus on sustainability and the deepening of sustainable practices for port cities, people have begun to pay attention to the implementation effects of sustainable plans or policies for port cities. Assessing sustainability performance or establishing evaluation standards are complex tasks involving multiple factors and various quantitative indicators [30]. Chen and Lam [51] applied a two-stage Data Envelopment Analysis (DEA) approach to measure and compare the sustainability efficiency of 20 world-leading container port cities. Schipper et al. [52] applied a series of social, economic and environmental key performance indicators (KPIs) to evaluate the development level of sustainable ports and cities. Cavallo et al. [53] used the Analytic Hierarchy Process (AHP) to evaluate and make decisions on the sustainable development proposal for the port city of Naples. Attardi et al. [54] took a Strategic Environmental Assessment (SEA) approach to conduct an environmental assessment of Taranto and Brindisi, two industrial port cities in Italy. Wang et al. [55] evaluated the ecological impact of development policy for port cities. Mrak [56] created decision-aid tools to evaluate the sustainability of the development plans for a port region. The circular city is becoming a new practice for sustainable urban development. Some researchers proposed an evaluation index system for the circular city [57,58]. Others [59] applied the concept of the circular city to the practice of the recycling seaport, and evaluated its performance.

Focus 3: the impact of stakeholders on the sustainability of port cities

‘Stakeholders’ refers to people, organizations or groups that have obvious interests or influence on the policies adopted. There are four groups of port city stakeholders: internal stakeholders, the public sector, market players/corporate bodies, and community/interest groups. ‘Internal stakeholders’ mainly refers to port employees, managers, owners and supervisors, etc.; ‘public sector stakeholders’ mainly refers to port authorities, national governments and relevant departments, etc.; ‘market players/corporate bodies’ mainly refers to stakeholder organizations, such as shipowners, transportation companies and logistics companies, etc.; community/interest groups mainly refer to local residents living near the port, consumers and taxpayers, and non-profit organizations. For the sustainability of port cities, it is important to identify the key stakeholders and the goals they seek, in order to reasonably balance the relationship between economic, social, and environmental performance for port cities [9]. Ignaccolo et al. [60] believed that the participation of stakeholders in sustainable port planning was conducive to the common sustainable development of port communities and ports. Bossuyt and Savini [61] studied the role of political parties in formulating sustainable urban policies. Hoyle [62] explored the degree and the nature of the influence of community groups on the changing processes and patterns of the urban waterfront. Frantzeskaki et al. [63] studied the role of partnerships in sustainable urban governance. De Lara [64] studied the ways in which the policymakers of the cities of Long Beach and Los Angeles in the United States incorporated racial, environmental, and class instability into the region’s ecological structure, in order to resolve racial and class differences among the port workers.

Focus 4: the problems facing the sustainable development of port cities

Natural disasters such as rising sea levels, tsunamis, and beach erosion caused by human factors has affected the sustainable development of some port cities [65–69]. The air pollution and traffic congestion caused by port production and operation activities has affected the air quality of port cities and the quality of life of their residents [70–72]. The development of cruises and tourism has increased air pollution and traffic congestion in port cities [73–75]. In some port cities, the intensity of the land expansion in the port area was higher than that of the entire central city, which was not conducive to
the expansion of the urban living space and public living space, and thus affected the quality of the human settlements [76].

Focus 5: technologies, methods and measures to promote the sustainability of port cities

In port cities, the endogenous climate resilience [77] and new smart technologies [78] could be used to deal with climate change and to manage water. Yigit and Acarkan [79] proposed a new power management method and algorithm for ships using hybrid energy in ports. Odindi and Mhangara [80] suggested the use of remote sensing technology to monitor the trend of green space in the city of Port Elizabeth, in order to optimize the social environment and the natural functions. Van Timmeren et al. [81] believed that optimizing the energy balance and using renewable energy could promote sustainable port city regeneration.

The use of interactive visual support tools [82] and the Historical Urban Landscape (HUL) approach [27,83] could help develop the port area into a hot spot for the sustainable development of port cities, and could realize the smart and sustainable development of port cities. Ravetz [84] suggested that the “synergistic mapping” approach had played a role in the sustainable economic development of port cities. The application of circular economy methods in ports generated a large amount of waste value-added, and promoted the sustainable development of port cities [7,85]. The PHEBUS (it is a multidisciplinary research team) research group helped port cities to design, evaluate, compare and select solutions for future sustainable development by using thematic research and integrated system approaches [86].

Improving the traffic management policy or infrastructure of port cities [87] and implementing sustainable urban mobility planning [88] would help to reduce port emissions and traffic congestion, and would respond to the challenges of sustainable development for port cities [89]. The development of an integrated modelling-measurement system for the near-real-time assessment of port activities on air pollution could strengthen port pollution management and improve the air quality in port cities [90]. The use of the urban growth boundary (UGB) delimitation method [91], the implementation of integrated territorial investments (ITI) [92], the improvement of the utilization efficiency of urban land [93], and the designing of urban blue space [94] could promote the sustainability of the ecological environment of port cities. Using material flow analysis (MFA) to analyze the urban metabolism (UM) was conducive to resource management and supported the sustainable environmental planning of port cities [95]. The implementation of a smart urban metabolism (SUM) could support the sustainable development of port cities [96]. Different departments of the city have operated in an integrated manner to achieve sustainable development, which played an important role in the sustainability of port cities [97]. Meyer et al. [98] proposed that the sustainable development of Rotterdam must establish links between strategies, projects and participants. Van Tuyl and van den Berg [5] believed that a great social value could be produced for Rotterdam by holding an annual city festival—World Port Day (WPD)—to show citizens the port and its related industrial activities.

Table 5. Classification according to research focus categories.

| Research Focus Categories | Articles (Totally Selected 61 Articles) | Frequency | Percent |
|---------------------------|----------------------------------------|-----------|---------|
| Focus 1: The impact of ports and cities interaction on sustainability of port cities | Fusco Girard (2010), Megahed (2014), Gurpinar and Balcioğlu (2018), Holmstedt et al. (2017), Hein (2014), Liu et al. (2019), Li et al. (2019), Pugliano et al. (2018), Xiao and Lam (2017) | 9 | 15% |
| Focus 2: The evaluation of sustainable performance (plans, policies and programs) with port cities | Chen and Lam (2018), Schipper et al. (2017), Attardi et al. (2012), Cavallo et al. (2015), Wang et al. (2009), Mrak (2013), Fusco Girard and Nocca (2019), Gravagnuolo et al. (2019), Williams (2019) | 9 | 15% |
| Focus 3: The impact of stakeholders on sustainability of port cities | Lam and Yap (2019), Ignaccolo et al. (2018), Bossuyt and Savini (2018), Hoyle (1999), Frantzeskaki et al. (2014), De Lara (2017) | 6 | 10% |
Table 5. Cont.

| Research Focus Categories                                                                 | Articles (Totally Selected 61 Articles)                                                                 | Frequency | Percent |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------|---------|
| Focus 4: The problems facing the sustainable development of port cities                      | Sheeran and Pilato (2017), Ito et al. (2019), Gravalle and Mimura (2008), Zanetti et al. (2016), Aragonés et al. (2017), Kwon et al. (2019), Lee et al. (2019), Younger et al. (2015), Ruiz-Guerra et al. (2019), Rosa-Jiménez et al. (2018), Dundović et al. (2013), Zheng Wang et al. (2017) | 12        | 20%     |
| Focus 5: Technologies, methods and measures to promote sustainability of port cities        | Meyer et al. (2012), Karimpour et al. (2019), van Tuijl and van den Berg (2016), Yigit and Acrarkan (2018), Ezarat (2016), Fusco Girard (2013), Morel et al. (2013), Odindi and Mhangara (2012), Ravetz (2014), Trundle et al. (2019), Dircke and Molenaar (2010), Van Timmeren et al. (2012), Kourtit and Nijkamp (2013), De Rosa and Di Palma (2013), Tang et al. (2017), Przybylowska (2018), Przybylowski (2019), Merico et al. (2019), Zheng, Yang et al. (2017), Delitheou and Georgakopoulou (2019), Li et al. (2016), Wessells (2014), Voskamp et al. (2017), Shahrokni et al. (2015), Mammadova (2017) | 25        | 41%     |
| Total                                                                                       |                                                                                                       | 61        | 101%    |

3.3.3. Research Methods

According to the methods and means of the research design and data acquisition, the research methods can be divided into qualitative research and quantitative research [31]. Qualitative research is based on textual descriptions or explanations, and the field study, historical comparison and other methods are often used. Quantitative research is based on data analysis, the methods such as experiments and surveys are often used. Of the 61 articles, 51% of the articles adopted qualitative research, 38% of the articles adopted quantitative research, and 11% of the articles adopted both qualitative and quantitative research (Table 6).

Table 6. Distribution of the research methods in the articles.

| Research Methods Of Study       | Articles (Totally Selected 61 Articles)                                                                 | Frequency | Percent |
|---------------------------------|--------------------------------------------------------------------------------------------------------|-----------|---------|
| Qualitative Study               | Fusco Girard (2013), Morel et al. (2013), De Lara (2017), Xiao and Lam (2017), Ezarat (2016), Hoyle (1999), Meyer et al. (2012), Frantzeskaki et al. (2014), Hein (2014), Ravetz (2014), Pugliano et al. (2018), Attardi et al. (2012), van Tuijl and van den Berg (2016), Gravagnuolo et al. (2019), Williams (2019), Bossuyt and Savini (2018), Przybylowska (2019), Sheeran and Pilato (2017), Mammadova (2017), Holmstedt et al. (2017), Wessells (2014), Dundović et al. (2013), Dircke and Molenaar (2010), Megahed (2014), Van Timmeren et al. (2012), Aragonés et al. (2017), Fusco Girard (2010), Ignaccolo et al. (2018), Younger et al. (2015), Trundle et al. (2019), Przybylowski (2018) | 31        | 51%     |
| Quantitative Study              | Schipper et al. (2017), Chen and Lam (2018), Yigit and Acrarkan (2018), Cavallo et al. (2015), Liu et al. (2019), Odindi and Mhangara (2012), Li et al. (2019), Fusco Girard and Nocca (2019), Lee et al. (2019), Merico et al. (2019), Ruiz-Guerra et al. (2019), Ito et al. (2019), Rosa-Jiménez et al. (2018), Zheng, Yang et al. (2017), Zheng, Wang et al. (2017), Tang et al. (2017), Voskamp et al. (2017), Wang et al. (2009), Gurpinar and Balcioglu (2018), Li et al. (2016), Zanetti et al. (2016), Gravalle and Mimura (2008), Kwon et al. (2019) | 23        | 38%     |
| Qualitative and Quantitative Study | Kourtit and Nijkamp (2013), Lam and Yap (2019), De Rosa and Di Palma (2013), Karimpour et al. (2019), Shahrokni et al. (2015), Delitheou and Georgakopoulou (2019), Mrak (2013) | 7         | 11%     |
| Total                           |                                                                                                       | 61        | 100%    |
4. Conclusions and Future Research

4.1. The Main Findings of the Research

Port sustainability has become an increasingly important research topic during the past ten years. From the perspective of geographic research areas, European port cities are the hot spots for sustainability research. Regarding research fields, technologies, methods and measures to promote the sustainability of port cities are popular research topics. In terms of research methods, qualitative research plays an important role in the study of port city sustainability.

4.2. Future Research Directions

We suggest that the future research on port city sustainability should follow five directions:

1. Expanding the regional scope of the case study.

According to the latest list of the world’s top 100 container ports released by Lloyd’s Daily, in the UK, the top ten container ports are all in Asia, and seven of them are in China [99]. Port cities face different challenges between Europe and Asia. In Europe, due to the low interdependence and relatively stable relationships between ports and cities, the functions of ports and cities were separated earlier, and most of the waterfront areas were redeveloped because of their long history and rich cultural resources. In Asia, ports and cities have developed in a symbiotic manner, and the interdependence between ports and cities is strong, and is in a downward trend [100]. In Africa, there is huge economic potential, and great space for the development of ports and port cities. Due to the different relationships between ports and cities among different regions, the problems faced by the sustainable development of port cities are also different. One port city can learn from another’s experiences, but cannot copy them. Therefore, it will be helpful to conduct additional case studies focusing on differences in port cities between Asia, Africa and South America in the future.

2. Enriching the assessment content for the sustainable performance (plans, policies and programs) of port cities.

As shown in Table 5, there are only nine articles related to the assessment of sustainable performance (plans, policies and programs) for ports and port cities, mainly using environmental, economic and social sustainability indicators. The content of environmental assessment mostly focuses only on the impact of the port’s activities and infrastructure on the natural (urban) system, but rarely involves the risk assessment. On 4 August 2020, an explosion occurred at a dangerous goods warehouse in Port Beirut, Lebanon. At least 200 people were killed, and about 5000 were injured. A large number of buildings near the port were destroyed. As many as 300,000 people were temporarily homeless, and the damage could reach $10–15 billion [101]. On 12 August 2015, a large explosion occurred in a dangerous goods warehouse in Tianjin Port, China. About 173 people were killed, a large number of buildings and containers were destroyed, and economic losses of $1.1 billion were caused [102]. In view of the staggering damage caused to port cities by the occurrence of port accidents, it is necessary to strengthen the risk assessment of ports and port cities in the future.

3. Paying attention to the application of clean energy technologies in sustainable ports and port cities.

Clean energy sources, such as wind energy, solar energy, wave energy, and renewable energy are continuing to change the world. The development of clean energy technologies provides a broad prospect for the reduction of pollution in ports and port cities. Paying attention to the research and application of clean energy technologies in the sustainable development of ports and port cities is a future development trend.

4. Promoting artificial intelligence in sustainable ports and port cities.

In recent years, artificial intelligence (AI) technology has developed rapidly, and has attracted the attention of many countries and regions for the promotion of sustainable development goals. In terms of environmental sustainability, machine learning and computational simulations can help port cities to recognize climate changes and take actions. AI can be used to monitor environmental damage, and to...
provide early warning of major events in ports and port cities. In terms of social sustainability, AI can excavate port cultural heritage, which is beneficial for port cities in that it allows them to promote the harmonious development of society, the economy and the environment, while protecting ports’ cultural heritage.

(5) Applying landsenses ecology in sustainable ports and port cities.

There are many ports in the world which often have rich tangible and intangible cultural values due to their long history. It is of great significance for the port city system to transform the urban port landscape into a sustainable and creative hot spot while protecting the ports’ cultural heritage. The strengthening of the planning of ports and port cities is hugely important. Landsenses ecology is based on ecological principles and the analysis framework of natural elements, physical senses, psychological perceptions, socioeconomic perspectives, process–risk, and so on, and is closely linked with ecosystem services and sustainable development through landsense creation [103]. In the future, will be important to promote the application of landsenses ecology in the renewal of ports and port cities. Whilst it protects the coastal ecosystem and the historical and cultural heritage of ports, it also mobilizes people’s physical and psychological perceptions, creates the port’s image, stimulates the economy while meeting social needs, and realizes the regeneration and sustainable development of port cities.

Author Contributions: Conceptualization, Y.Z.; Project administration, J.Z.; Methodology, G.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: This research was supported by the Training Program of Fujian Excellent Talents in University (FETU). The authors thank Ziheng Xu for improving the writing of this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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