

Advancing port sustainability: Essentials for a model concession agreement framework

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Abstract: Concession agreements (CAs) in the port sector are designed to establish mutually beneficial arrangements for involved parties. They serve as catalysts, enabling ports to attract adept private investors and secure requisite funding to enhance port infrastructure, superstructure, and service quality. Concurrently, the imperative to mitigate negative externalities and promote sustainable practices in port organization and development remains paramount. In this context, the paper explores the nuanced landscape of CAs, specifically focusing on the urgent need for an innovative framework that integrates sustainability within port organization, operations and development. Drawing from existing academic discourse and field evidence, it systematically identifies, examines, and analyzes fundamental requirements and key factors that should be considered in CAs, in line with sustainable development and proposes a reference framework for an ideal Concession Agreement model. Despite evident strengthening of sustainability implications in port concessions, significant room for improvement persists. Nevertheless, dynamics in the field create a certain optimism for the future.

Keywords: concession agreements; ports; sustainability

1. Introduction

The port industry is evolving in a highly competitive global environment. As a result, ports strive to expand their market share, in order to boost their business and increase their turnover. At the same time, as key players in logistic chains and global transport operators and their decisions have a strong impact on ports' role, market position and development prospects, ports put great efforts into improving their performance and services to become more attractive in terms of different criteria and considerations. Environmental and social concerns have only recently begun to affect strategic decisions to some extent, but still a new reality for ports and the port industry emerges, as also shown by the review of a growing scientific literature (Davarzani et al., 2016; Lim et al., 2019; Özispa and Arabelen, 2018). Ports face increasing pressures to achieve sustainability targets and reform their organization, operation and development in this complex setup (Deloitte and ESPO, 2021; ESPO, 2021; World Ports Sustainability Program, 2020). These pressures will continue to grow in the years to come, even more so in the perspective of the European Green Deal and the EU sustainability priorities in the case of European ports. It is therefore an imperative to promote reliable, efficient and sustainable solutions in order to meet old and new challenges, as well as social and environmental expectations, especially within the framework of a rapidly evolving and highly challenging transport industry.

In any event, an opportunity arises as major changes in the port industry may bolster competitiveness, increase economic results and business prospects, improve the environmental footprint of ports and other entities of the port cluster, and ameliorate relations between ports and cities/local communities, whereby there is plenty of room for raising current levels of information for the issues and visibility in the sector. For this reason, port operators and port service providers progressively incorporate innovative sustainable strategies and practices in their organization, management and operations. Furthermore, they modernise, adjust and improve their business models, port infra- and superstructures, as well as the services they provide.

The abovementioned issues need to be duly taken into consideration in concession agreements (CAs) for/in ports, which have provided the prevailing model for private sector involvement in the port industry over the last 25 years, especially in Europe.

CAs in the port sector are used with the intention of establishing win-win situations for all parties involved. They enable ports to attract suitable private investors with knowledge and experience in the field, as well as to mobilize sufficient funds from the private sector, that allow ports to finance necessary investments in port infra- and superstructure and the provision of high-quality port services with specific quantitative and qualitative characteristics. They have evolved into a powerful strategic tool for state and/or ports, as they determine strategic goals, providing the framework for infra- and superstructure development, modernization of port operation, as well as upgrade and improvement of services, while they include specific obligations and requirements to be met by port operators and providers of port services in the short-, medium- and long-term. At the same time, it is essential to address negative externalities and promote solutions for sustainable port organization, operation, and development.

In this context, amid significant transformations within the port industry driven by altering production and consumption patterns, global competition, and escalating sustainability pressures, this paper systematically identifies, examines, and analyzes fundamental sustainability requirements aligned with the three pillars of sustainable development—economic, social, and environmental—that should be considered in port CAs. By focusing on key factors corresponding to these strongly interlinked dimensions, the paper aims to unveil essential elements comprehensively, suggesting not only their intricate interaction but also the need for a nuanced and balanced approach in crafting a model concession agreement.

Following this introductory section 1, section 2 provides a literature review on the subject, revealing a conspicuous gap in existing published research. Section 3 outlines the adopted methodology and the utilized data sources while acknowledging certain limitations related to data availability. Section 4 presents the research findings, setting the stage for a comprehensive examination and discourse in section 5. The culmination of this research unfolds in section 6, where the paper reaches its conclusions.

2. Literature review and scope

Even though CAs in ports have been negotiated, concluded, and implemented for

quite a long period, holding obvious significance for the sector and impacting beyond the parties involved or the ports themselves, academic research has shown only a limited interest in the subject. The discussion has primarily focused on concrete aspects of CAs in ports, without identifying critical factors for CAs or suggesting a standardization methodology or a model for CAs whatsoever. This is more surprising in the light of sustainability discussion related to ports and the port industry in general, which should include at least the most relevant and impactful aspects of port organization, operation, and development, if at all. Moreover, the capacity of information management and information governance in CAs has not yet been discussed in detail. Since CAs provide the binding legal framework to this end and at the same time they are the tool to introduce and implement sustainability targets and strategies in the ports, it would have been expected that research and discussion would extend to the nature, objectives, content, and specifics of CAs. The subject has so far remained in the shadow of other fields and aspects.

A comprehensive examination of the existing literature indicates that researchers have primarily concentrated on two significant areas:

- Identification of appropriate indicators to assess the operation of a port in terms of sustainability, as well strategies to promote sustainable port development.
- Utilizing concession agreements in the port industry as a means to enhance the operational efficiency of a port, improve its overall effectiveness, and boost its development prospects, generating benefits for all stakeholders.

However, as evidenced by the literature review, these two areas were considered separately in almost all cases, also leaving many aspects unexplored.

2.1. Sustainability in ports

Sustainable operation and development of ports have been discussed in a large body of academic literature, whereby many different facets were addressed. Researchers have focused, *inter alia*, on:

- mainstreaming of sustainability/environmental implications in ports or port activities (Chlomoudis et al., 2022; Hossain et al., 2019, 2021; Housni et al., 2022);
- sustainability and port governance (Baltazar and Brooks, 2001; Brooks and Pallis, 2008; Brooks and Cullinane, 2007; Brooks, 2004; ESPO, 2010);
- greening the ports (Lam and van de Voorde, 2012; Notteboom et al., 2021) and addressing environmental issues (Puig et al., 2015; Puig and Darbra, 2019; López-Navarro et al., 2015; Adams et al., 2009);
- direct and indirect contribution to the regional economy (Deng et al., 2013; Angelopoulos and Chlomoudis, 2017) and economic growth (Park and Seo, 2016);
- the negative impact of port activities on the regions (Girard, 2013) and the environment (Dinwoodie et al., 2012; Puig et al., 2015, 2017);
- environmental management in ports (Puig et al., 2022, 2020; Di Vaio and Varriale, 2018; García-Onetti et al., 2018; Kuznetsov et al., 2015);
- the relation between economic performance and good environmental practices (Cheon et al., 2017; Pallis et al., 2017);

- adequate methods to assess sustainability in ports based on different indicators (Di Vaio et al., 2018; Housni et al., 2021; Styliadis et al., 2021) or even suggesting a composite index based on a set of relevant indicators (Laxe et al., 2017; PORTOPIA, 2018).

Although this field has already attracted a lot of interest in recent years, it is considered as a new landscape and research still needs to shed light on many different aspects of sustainability in ports and the port sector. In the years to come, research and academic discussion will provide interesting and useful results.

2.2. CAs in port industry

Over the last two decades, researchers have shown a growing interest in CAs in the port sector. This heightened attention is a response to the evolving dynamics of the industry and the widespread adoption of concession agreements as indispensable tools for both port operation and development. The increasing focus on CAs reflects their acknowledged significance in shaping the governance framework of ports (Notteboom, 2006). Recent literature illustrates the main directions and facets of the discussion (Van Hooydonk, 2022; Ferrari et al., 2019, 2015; Macário, 2014; Pallis et al., 2015; Panayides et al., 2015; Theys et al., 2010). Some sporadic attempts to focus on individual case studies provide useful findings for the sector (Wiegmans et al., 2022; Cabrera et al., 2015; Oblak et al., 2016). Having a reversed focus, other scholars opt for a segment-specific case study, drawing lessons from the analysis of port terminal concession contracts and applying them to the intermodal sector (Monios and Bergqvist, 2015). Some scholars concentrate their attention specifically on container terminals (Pallis et al., 2008; Zhou and Kim, 2021; Fraser et al., 2020), while others delve into certain categories of ports, e.g., landlord ports (Chen et al., 2014), or other specific topics such as reforming public port authorities through CAs (Panayides et al., 2017), concessions in ports under incomplete information (Zheng et al., 2020; Han et al., 2020) that only marginally touch upon the subject.

To this day, research and academic discussion pale in comparison with the importance of the issue for the entire sector and its impact, whereby only very few scholars have so far focused on environmental factors and the greening of CAs (Notteboom and Lam, 2018). Interest remained surprisingly low even after the EU issued Directive 2014/23/EU on the award of concession contracts that was expected to have stimulated discussion.

2.3. Scope and added value

The paper aims to make a substantial contribution to the academic discourse on the sustainable operation and development of ports, as well as the formulation of innovative CAs. This contribution is intended to add value to the scientific fields related to port governance and development, sustainability, and concessions. Combining these fields in an innovative approach provides originality to the research scope. Given the current limited depth of research and academic discussion on the subject matter, where only certain facets of sustainability in ports or concessions in ports have been examined separately, the systematic examination of critical factors for sustainable port development and the discussion of various aspects on a framework

methodology for CAs offer a unique perspective. This endeavor not only sheds light on the subject but also lays the foundation for further scientific research and discussion.

Simultaneously, the research on sustainable port development aims to catalyze sustainability-oriented societal change. The paper seeks to deepen knowledge and understanding in this field, facilitating a reconsideration of how ports and local communities can coexist harmoniously and collaborate to meet their respective needs, achieving synergies. This endeavor implies an alignment of scientific knowledge production with societal problem situations. Furthermore, the anticipated results are expected to be utilized by both public and private stakeholders involved in the design, negotiation, formulation, and monitoring of CAs. Decisions regarding concession agreements are of paramount importance. The complexity and significance of these decisions, such as determining the type of concession agreement, specifying terms and provisions to achieve an optimal balance among economic, environmental, and societal considerations, as well as defining expected gains and how burdens should be shared, underscore the need for a thorough approach. The evident importance lies in the potential long-term impact on sustainable port operation and development, as well as the benefits for all involved parties and third parties. This acknowledgment is crucial, reinforcing the necessity for a well-informed decision-making process rather than relying solely on vague criteria or intuition, as has been the case until today.

3. Methodology and data

The paper outlines a comprehensive methodology for identifying and assessing key considerations to be incorporated into port CAs, placing a specific emphasis on sustainability. The analysis framework and requirements are structured to address the inherent complexity of sustainability, which encompasses three distinct yet interconnected and equally critical dimensions: the economic, social, and environmental aspects. However, the economic dimension dominates the design, negotiation, conclusion, and implementation of CAs in ports, revealing a disproportionate focus on economic considerations while the environmental and social dimensions receive comparatively only limited attention. Given this disparity, the paper prioritizes environmental and social considerations, advocating for a more balanced and equitable integration of all three dimensions within the relevant provisions of CAs. Moreover, the paper emphasizes the need to extend this balance to the awarding criteria applied in the concession process. By doing so, the methodology seeks to foster a more inclusive and comprehensive approach that aligns with the principles of sustainable development in the port sector, ensuring responsible outcomes for all stakeholders involved.

The examination of existing literature has played a pivotal role in shaping the research design and delineating its trajectory, while concurrently providing a framework for evaluating the outcomes. In addition, through the analysis of specific data from selected CAs in ports, the paper identifies crucial elements essential for the incorporation of sustainability, potentially leading to contractual obligations. The sample of available CAs, including contracts and amendments, is presented in the following **Table 1**.

Table 1. Considered sample of CAs in ports (source: authors, 2024).

Port	Location (country)	Concession type	Concessionaire	Date
Piraeus	Greece	Master concession	COSCO	2016
Thessaloniki	Greece	Master concession	SOUTH EUROPE GATEWAY THESSALONIKI	2018
Igoumenitsa	Greece	Master concession	GRIMALDI GROUP	2023
Mumbai	India	Landlord (DBFOT)	N/A (draft)	2021
Ehoala	Madagaskar	Landlord (DBFOT)	PORT D'EHOALA L.C.	2006
Vizhinjam	India	Landlord (DBFOT)	ADANI PORTS	2015
Wilmington	USA	Landlord (ROT)	GULFTAINER (GT)	2018
Detroit/Wayne County	USA	-	AMBASSADOR PORT COMPANY	2005
Matarani	Peru	Landlord (BROT)	TERMINAL INTERNACIONAL DEL SUR S.A. (TISUR)	1999
Puerto Bolivar	Equador	Landlord (ROT)	YILPORT HOLDING	2016
Puerto Plata	Dominican Republic	Master concession	PUERTO PLATA PORT INVESTMENTS L.C.	2018

The sample is utilized in an exploratory manner to gather initial insights into the subject and operational approaches in the field of port concessions. The table provides key details, including the port authority and location (country) of the port, the concession type, the concessionaire/port operator, and the date of the latest contract signing. It is essential to acknowledge that, at this early stage of research, the insights obtained are preliminary. While this material forms the foundation for examining the hypotheses proposed in the paper, further investigation, targeting a more extensive sample, is considered necessary to obtain a comprehensive understanding.

As there's no established model for sustainable port agreements, the research ensures methodological robustness and comparability by adhering to internationally recognized reference texts. This adherence encompasses standardized text endorsed by esteemed international organizations such as the World Bank, the United Nations, and national authorities or agencies which delineates best practices for sustainable infrastructure projects and CAs. Additionally, it aligns with the 2014/23/EU Directive, relying on its approach and provisions in evaluating available material systematically and objectively. In concrete, the paper drew upon existing materials as follows (presented in alphabetical order):

- Africa Transport Policy Program (SSATP). Container Terminal Concession Guidelines (2017).
- European Union. Directive 2014/23/EU on the award of concession contracts (2014).
- Ministry of Shipping, Road Transport and Highways—Government of India. Model Concession Agreement for Private Sector Projects in Major Ports (2021).

- United Nations—Economic and Social Commission for Asia and the Pacific (UN-ESCAP). Model Agreement Development of a Dry Port under PPP mode (2016).
- United States Agency for International Development (USAID). Port Agreement Templates (2018).
- World Bank Group. Sample Port Concession Agreement (2009).

Overall, this comprehensive approach enables a systematic and objective evaluation of available material, thus augmenting a profound understanding of the subject matter.

One of the greatest challenges by the elaboration of the paper was available material concerning sustainability in port CAs. The lack of available material can be attributed to several factors. Historically, the port sector has received relatively less attention in terms of sustainability research, resulting in fewer dedicated studies on CAs. Additionally, confidentiality and proprietary information constraints prevent detailed disclosure of sensitive data related to operations and financial arrangements. Inconsistent reporting practices and challenges in collecting comprehensive data on social, environmental, and financial aspects further hinder research efforts. Some ports and concessionaires do not publish accessible sustainability reports, limiting researchers' access to critical data and case studies. Moreover, the port industry's slower adoption of sustainability practices and the early stage of sustainability initiatives contribute to the scarcity of long-term data. The absence of specific regulatory requirements for sustainability reporting in CAs also affects data sharing. As sustainability gains prominence in port operations, it is anticipated that data availability and transparency will improve over time. Scientific research and discussion need of course to continue, even in a less favorable environment. To address the abovementioned challenges, further research requires a multi-faceted approach, combining publicly available data, academic research, stakeholder engagement, and case studies from leading sustainable ports. Collaborative efforts between industry stakeholders and researchers are crucial in enhancing data availability and advancing understanding of sustainability practices in CAs for ports and may lead to significant results.

4. Research findings

4.1. Sustainability in ports as a framework for CAs

Despite the increasing prominence of sustainability in ports, the topic lacks a broad consensus among scholars, industry experts, international organizations, and governmental bodies regarding its definition, content, or specifics. While there is a shared understanding of its focus and basic principles as outlined in international frameworks, policy and strategy papers, guidelines, or industry-specific initiatives, the ongoing discussion reveals not only the complexity of the sustainability issue but also underscores the intricate nature of the sector itself.

Attempting a descriptive definition of sustainability in the port sector in general, we emphasize that it refers to a new holistic approach, seeking to integrate economically, environmentally, and socially responsible practices in the planning, development, and operation of port facilities and related activities and to balance

economic growth, environmental protection and social well-being, with the purpose to ensure long-term viability and resilience of ports and their surrounding communities. This definition makes it clear that sustainability can be understood in many ways, while the desired level of sustainability is inexplicit. CAs need to incorporate sustainability provisions in a quite uncertain landscape, for which justification might be vague and even ambiguous. In addition, the inclusion of several very different and mostly interconnected aspects, but also the different weight attributed to them are obstacles that are hard to overcome. Therefore, it is quite challenging to propose a CAs model for a sustainable port taking into consideration all different substantial aspects. The task is even harder because of the many differences of ports and the specificities of each case, while concrete provisions and details of CAs may vary widely based on the context and terms of each concession. However, elaborating one or more framework models for CAs in ports will be an advanced task for both the academia and governance and may be very beneficial in multiple ways for all parties involved.

4.2. Current state

The current analysis of port CAs, based on the sample considered, reveals a significant disparity in the treatment of economic, environmental, and social considerations. Economic parameters prominently dominate these agreements, showcasing a well-established understanding and implementation in the field of port concessions. Detailed clauses and terms related to economic aspects are thoroughly elaborated, indicating a high level of precision.

In contrast, environmental and social considerations receive limited attention, lagging significantly behind the detailed coverage seen in economic parameters. Concession agreements addressing these aspects tend to do so in a general and vague context, with scant references and a lack of specific, binding terms for concessionaires/port operators, highlighting a clear gap in understanding or commitment to these crucial dimensions.

The observed imbalance raises concerns about the depth of integration and commitment to sustainability practices within port concession agreements. This stems from a historical emphasis on prioritizing economic considerations, leading to detailed clauses related to financial performance and operational efficiency. Regulatory frameworks, potentially emphasizing economic efficiency, coupled with limited awareness of the interconnectedness of sustainability and short-term perspectives, contribute to the neglect of environmental and social aspects. The perceived complexity of quantifying and integrating these considerations may further deter stakeholders from incorporating specific terms in concession agreements.

This situation presents an opportunity for exploration and emphasizes the need for comprehensive sustainability provisions addressing economic, environmental, and social dimensions in a balanced manner. The evolving global discourse on sustainability, not fully integrated into current agreements, underscores the necessity for a paradigm shift. Addressing this issue requires a comprehensive and forward-looking approach, recognizing the evolving discourse on sustainability and ensuring a balanced integration of economic, environmental, and social factors for responsible

and resilient port development.

4.3. Towards a reference framework for CAs

Despite the fact that various organizations and entities have undertaken efforts to develop frameworks, guidelines, and best practices that potentially serve as references for sustainability in the port sector, the absence of a single standardized reference text for sustainable CAs level remains evident. For example, renowned entities like the International Association of Ports and Harbors (IAPH), the European Sea Ports Organization (ESPO), and the World Bank have published guidelines and toolkits aimed at fostering sustainable port management, operation, and development. These materials may encompass provisions concerning environmental protection, social responsibility, transparency, and long-term planning. Moreover, it is worth noting that certain countries possess their own distinct guidelines or templates for CAs in ports, specifically tailored to address sustainability aspects. The existing documents offer valuable insights into integrating sustainability considerations into CAs, but they do not provide comprehensive and universally applicable guidance.

In the subsequent subsections, we focus on exemplary texts that hold a major relevance for the subject at hand, examining their adequacy and implications for sustainability.

4.3.1. Standardized agreements, guidance manuals and toolkits

The “Model concession agreement for private sector projects in major ports”, published by the Indian Ministry of Shipping, Road Transport and Highways (Indian Ministry of Shipping, Road Transport and Highways, 2021) outlines the policy and proposed contractual framework for establishing and operating ports in India under a Design-Build-Finance-Operate-Transfer (DBFOT) arrangement. The focus of this model agreement is on facilitating limited recourse financing for port infrastructure projects by addressing various critical aspects. It primarily centers on addressing critical aspects related to risk allocation, cost predictability, dispute resolution, and financial support for the projects. While these factors are essential for facilitating private sector participation and limited recourse financing in port infrastructure projects, the absence of explicit provisions regarding sustainability considerations is notable, despite touching on certain environmental and labor issues with reference to relevant legislation.

In 2007, the World Bank released the second edition of the “Port reform toolkit,” specifically focusing on “Legal tools for port reform” in Module 4 (World Bank, 2007). This module outlines essential aspects to consider when formulating legislation for port reform, aiming to establish a legal foundation for regulatory and contractual arrangements that are marketable and bankable. While not explicitly emphasizing sustainability as a primary framework for negotiating and concluding concession agreements, the module offers a comprehensive set of guidelines, that touch upon environmental considerations and, to some extent, social aspects. It introduces reference provisions that serve as tools for shaping the legal framework, suggesting clauses related to port safety, environmental protection, general regulations, reporting, handling dangerous cargoes, waste management, operator’s rights and obligations, information and communication, miscellaneous conditions, building conditions, site

conditions, and environmental permits. Despite this breadth, the guidelines the guidelines remain rather general in addressing environmental considerations, with social aspects receiving comparatively less explicit attention. Therefore, while acknowledged as a valuable reference until today, the text requires further refinement to achieve a comprehensive analysis necessary for effectively incorporating sustainability into concession agreements, with crucial additions needed for both social and environmental aspects.

In 2009, the World Bank Group elaborated a sample document specifically intended for the PPP Infrastructure Resource Center for Contracts, Laws, and Regulations (PPPIRC) website (World Bank Group, 2009). The central aim of this document was to offer reference material for the formulation of CAs in the context of ports. It sought to provide guidance and insights to stakeholders involved in concessions, incorporating some environmental provisions, and addressing labor-related matters, such as safety, health, and training, among others. Though, this reference text did not explicitly focus on promoting sustainability in port operations and development. Notably, the term “sustainability” was not specifically mentioned in the document’s content, indicating that its primary scope did not encompass a comprehensive consideration of sustainability aspects encompassing economic, social, and environmental dimensions. Therefore, while the document serves as a valuable resource for structuring CAs in ports, conceding authorities and potential concessionaires should recognize the limitations of the text regarding sustainability and seek additional resources or expert advice to ensure that concessions align with broader sustainability goals and encompass all pertinent aspects for responsible and sustainable port operation and development.

In 2016, the Economic and Social Commission for Asia and the Pacific (ESCAP), a regional commission of the United Nations, released a model agreement aimed at developing a dry port project under a public-private partnership (PPP) framework in the Asia-Pacific region (United Nations—Economic and Social Commission for Asia and the Pacific (ESCAP, 2016). This model agreement presents valuable insights into environmental considerations that can also be applicable to CAs (CAs) for maritime ports. Notably, the model agreement emphasizes the importance of conducting a comprehensive environmental audit and implementing an environmental management strategy to address and manage the environmental conditions of the dry port. Additionally, the agreement outlines the need for an environmental monitoring program to assess the dry port’s environmental condition over time, accompanied by an annual review of the Strategy. However, it is noteworthy that the model agreement lacks specific details and does not address social considerations or sustainability aspects, which are critical components to be included in CAs for promoting holistic and responsible port development.

In 2018, the United States Agency for International Development (USAID) (2018) produced a document titled “Port agreement templates”. The document outlines fundamental contracts between port authorities and private operators, focusing on the development and operation of port infrastructures and services. It underscores the importance of negotiating specific terms and conditions on a case-by-case basis, taking the contract’s context into account. The templates include provisions addressing environmental and social dimensions, such as the obligation for an environmental and

social impact study, protection of cultural heritage, and compliance with laws and regulations. Overall, the document demonstrates a commendable effort to integrate environmental and social aspects into port concession agreements, emphasizing compliance with local and international regulations, environmental impact assessments, and the protection of cultural heritage. As a template, it offers a valuable foundation for crafting sustainable port concession agreements, emphasizing the need for customization based on specific contexts. However, some references to environmental and social aspects are somewhat general and lack specificity, potentially diminishing its precision as a reference point. The use of vague language, such as “compliance with applicable norms and standards,” raises concerns about its practical applicability. While highlighting important considerations, the document’s effectiveness as a comprehensive reference for stakeholders seeking to develop sustainable port operations may be limited by the absence of detailed guidelines and specific examples.

The Africa Transport Policy Program document, titled “Container terminal concession guidelines” (Juhel, 2017), surprisingly provides less foresight. Adopted in 2017, the document aims to assist port authorities and ministries of transport and infrastructure in making decisions on alternative concession schemes, time frames, and timely planning of extensions. It specifically aims to develop guidelines on container terminal concessions, offering strategic and practical advice to high-level government decision-makers and general managers of port authorities. The focus is on attracting professional private sector partners to invest in and operate container terminal facilities. However, the document falls short in explicitly addressing sustainability considerations.

The conspicuous scarcity of sustainability-related provisions in the aforementioned texts reflects the challenges associated with promoting and effectively implementing sustainability considerations in port CAs. These challenges stem from the complex interplay of divergent interests among various stakeholders involved in the concession design and negotiation processes. Moreover, the inherent dynamics of sustainability within the port sector pose formidable hurdles when making difficult decisions concerning the involvement of private investors. It remains a pertinent question whether a paradigm shift will transpire in the near future, given the existing pressures, the evolving dynamics of sustainable development, the evolving business culture, and the emergent opportunities in the industry. As the landscape continues to evolve, the port sector must contemplate alternative approaches to embrace sustainability imperatives and align them with the ever-changing demands and opportunities for fostering responsible and sustainable port development. Reference texts or models for CAs in ports are expected to follow the trend.

4.3.2. Directive 2014/23/EU

Directive 2014/23/EU on the award of concession contracts (European Union, 2014) is a legislation act adopted by the European Union (EU) on 26 February 2014. Its primary objective is to establish a harmonized legal framework for awarding concession contracts across EU member states. While the Directive has a very broad scope, applying to a wide range of CAs, it aims to promote transparency, competition, and efficiency and enhance quality features in the awarding process also in the port

sector. Among the essential aspects of the directive is its focus on promoting sustainability, recognizing the importance of incorporating environmental, social, and economic considerations in the award and management of concession contracts. By doing so, it seeks to foster more sustainable and responsible port operation and development across the EU. Therefore, the directive serves as a valuable reference text for both public and private entities interested in engaging in concession activities. By incorporating provisions that promote sustainability, the directive aligns with broader EU sustainability objectives and contributes to fostering environmentally responsible and socially inclusive ports within the European context.

To achieve this goal, the directive introduces several provisions that encourage sustainability practices in the port sector. With regard to environmental and social considerations, the directive allows conceding authorities to include environmental and social criteria respectively. In addition, the directive outlines grounds for the exclusion of candidates and requires contracting authorities to assess candidates' suitability based on objective and non-discriminatory criteria. This can encompass evaluating a candidate's track record in sustainability practices, previous experience in sustainable port management, and adherence to environmental and social standards. By screening potential concessionaires for their sustainability commitments, the directive supports the selection of partners with a proven dedication to sustainable business practices. The directive also allows for long concession durations, particularly for certain infrastructure projects. This encourages concessionaires to undertake sustainable investments and implement measures that promote environmental conservation and social responsibility over extended periods. Besides, the directive requires contracting authorities to publish information about the concession contract, including its terms, conditions, and the award criteria used in the selection process. This transparency ensures that sustainability-related criteria and considerations are made publicly available, fostering accountability and motivating concessionaires to align their proposals with sustainability objectives to enhance their prospects of securing the contract.

4.3.3. Future prospects

The increasing focus on sustainability in the port sector has led to a growing awareness of the need for standardized and sustainable CAs. As sustainable development gains prominence, it is possible that more standardized reference framework texts or models will emerge in the future to guide CAs in ports and promote sustainable practices throughout the industry. Similarly, sustainability-related awarding criteria for concession agreements are anticipated to undergo further refinement, enrichment, and expansion, becoming more widely utilized. These criteria will not only shape the expectations, approach, and attitudes of the parties involved but will also significantly influence the outcomes and impacts of the concessions. As the port industry embraces a more sustainable trajectory, these developments are expected to play a major role in promoting responsible and environmentally conscious practices.

4.4. Sustainability considerations to be integrated into port CAs

Table 2, as presented below, offers a comprehensive and abstract overview of

sustainability considerations for incorporation into port CAs. It systematically categorizes these considerations under three overarching pillars: economic, environmental, and social. Each pillar encompasses multiple aspects that are vital for fostering sustainable port operations and development. The table indicates the complex and multi-dimensional nature of sustainability and its implications for the sector. By addressing economic, environmental, and social considerations, the table sets a comprehensive foundation for considering sustainability and promoting relevant provisions in CAs. It must be stressed that aspects and considerations presented in the table are rather indicative than exhaustive, thus further customization and adaptation is required to respond to specific realities, as well as to suit the specific needs and challenges of individual ports or concessions.

Table 2. Sustainability considerations in CAs—3 sustainability pillars (source: authors, 2024).

Sustainability pillar	Sustainability aspect	Consideration in CAs
Economic pillar	Economic viability and growth	Ensure the financial robustness and long-term economic resilience, profitability and expansion for the port while contributing to overall economic growth.
	Throughput performance and revenue generation and sharing	Define specific throughput performance targets for passenger and cargo traffic, ensuring both consistent revenue generation and profitability, while implementing clear and transparent revenue-sharing mechanisms.
	Investment planning and infra-/superstructure development	Identify and implement critical/essential investments designed to enhance service quality, optimize efficiency, and secure long-term competitive advantages for the port.
	Fair competition and tariffs	Ensure fair competition and equal opportunities for all stakeholders, and establish fair, transparent, non-discriminatory, objective, and proportionate tariffs reflecting the cost of the service provided.
	Job creation and local economy	Support local job creation and opportunities for small and medium-sized businesses.
Environmental pillar	Environmental impact	Conduct comprehensive environmental assessments, identify measures to mitigate negative effects and reduce environmental footprint, while ensuring also alignment with the ecosystem approach and maritime spatial planning.
	Energy use and efficiency	Encourage the adoption of energy-efficient technologies to reduce emissions and optimize energy use and consumption.
	Renewable energy integration	Promote renewable energy sources to decrease fossil fuel reliance.
	Alternative fuels and onshore power supply	Promote environmentally sustainable practices within ports by encouraging the use of alternative fuels, reducing the carbon footprint of port operations, and ensuring both onshore power supply and the provision of alternative fuels to ships.
	Waste management	Implement sustainable waste practices and hazardous materials handling.
	Water conservation	Adopt measures for water conservation and minimizing impacts on local resources.
	Soil protection	Implement soil protection measures, ensuring a proactive approach and monitoring systems to promptly detect potential soil degradation or contamination throughout port operations, and using remediation strategies in case of compromised soil quality.
	Clean air	Ensure compliance with air quality standards and a clear commitment to clean air and sustainable practices within port operations.
Biodiversity protection	Preserve marine habitats and wildlife to safeguard biodiversity.	
Social pillar	Social and labor considerations	Address fair labor practices, ensure decent working conditions and compliance with labor laws and standards.
	Health and safety	Prioritize the health and safety of port workers, neighboring communities, and visitors, implementing measures to prevent accidents and respond to emergencies.

Table 2. (Continued).

Sustainability pillar	Sustainability aspect	Consideration in CAs
Social pillar	Port-city relationship	Establish a resilient and harmonious port-city relationship by promoting coordinated planning, effective communication, and a collaborative partnership that safeguards the interests of both the port and the city, ensuring mutual benefits.
	Community engagement	Involve local communities in decision-making and address socio-economic impact.
	Cultural heritage preservation	Respect and preserve cultural heritage sites and traditions within and around the port area.

4.4.1. Economic considerations

The economic considerations embedded within CAs in the port sector establish a crucial foundation for sustainable and mutually beneficial collaborations between port authorities and concessionaires.

Navigating the intricacies of aspects such as traffic volume, turnover, infra- and superstructure investment, technology and innovation, investment revenue, quality of services, operational terms, competition, tariff structure, and risk management, **Table 3**, as presented below, reveals a comprehensive overview of the multifaceted economic dimensions within CAs. Each aspect serves as a strategic pillar for port management and development. Their significance lies in their profound and interconnected impact on the economic dynamics of ports that, when harmoniously synergized, contribute to the overall success and resilience of port operations and development.

Table 3. Economic considerations for CAs in ports (source: authors, 2024).

Subject area	Description	Obligations for concessionaire
Traffic volume (passengers)	Number of passengers (coastal shipping/cruise shipping) passing through the port, impacting the port's economic viability and revenue generation.	<ul style="list-style-type: none"> Implement measures to achieve and maintain the specified passenger throughput targets. Invest in equipment, facilities and procedures to ensure the smooth flow of passengers through the port and support efficient passenger handling. Improve passenger/cruise terminals in the port.
Traffic volume (cargo)	Cargo volume (containers, bulk, cars, etc.), impacting the port's economic viability and revenue generation.	<ul style="list-style-type: none"> Develop and execute strategies to achieve agreed-upon cargo handling targets. Optimize the flow of goods through the port, as well as logistic services. Invest in equipment, facilities and procedures to ensure the efficient and safe handling of cargo. Improve container/cargo /car terminals in the port.
Turnover	Overall financial turnover generated by port activities.	<ul style="list-style-type: none"> Contribute a defined percentage of the port's turnover as concession fees, ensuring a sustainable financial partnership with the port authority. Provide transparent financial reporting to demonstrate adherence to turnover contribution obligations.
Infra- and superstructure investment	Investments required to enhance and maintain port infra- and superstructure.	<ul style="list-style-type: none"> Develop a comprehensive Master Plan outlining obligatory and non-obligatory infra- and superstructure investments. Execute obligatory investments outlined in the Master Plan, focusing on critical infrastructure needs for the port's long-term development and business strategy. Execute non-obligatory investments that align with industry best practices and emerging technologies, contributing to the port's competitiveness.
Technology and innovation	Integration of technological advancements for operational efficiency.	<ul style="list-style-type: none"> Implement and update technology solutions, ensuring that the port remains technologically competitive. Invest in research and development to identify and adopt innovative solutions that improve overall operational efficiency.
Investment revenue	Additional revenue streams generated through investment activities.	<ul style="list-style-type: none"> Actively participate in mutually agreed investment initiatives, contributing to the development of revenue-generating projects. Monitor and evaluate the financial performance of investment activities, adjusting strategies as needed to maximize returns.

Table 3. (Continued).

Subject area	Description	Obligations for concessionaire
Quality of services	Service standards and customer satisfaction levels.	<ul style="list-style-type: none"> Regularly assess and improve service quality based on agreed-upon standards, focusing on customer satisfaction and efficient service delivery. Implement feedback mechanisms to gather insights from port users and stakeholders, allowing for continuous improvement of service quality.
Operational terms	Operational parameters and efficiency benchmarks.	<ul style="list-style-type: none"> Adhere to specified operational terms, including efficiency benchmarks and performance standards outlined in the concession agreement. Implement operational best practices to ensure the port operates at optimal efficiency, meeting or exceeding defined benchmarks.
Competition	Ensuring a level playing field for port service providers and users.	<ul style="list-style-type: none"> Facilitate fair competition, allowing participation in economic activities within the port for all service providers and users, and ensure equal opportunities for all stakeholders. Implement measures that prevent distortion of competition.
Tariff structure	Ensure fair and adequate pricing models and tariffs for port services.	<ul style="list-style-type: none"> Abide by agreed-upon tariff structures and pricing policies, maintaining transparency in pricing practices. Develop a fair and competitive tariff structure that aligns with industry standards and encourages economic activities within the port. Conduct regular assessments of pricing models, considering industry benchmarks and economic factors, to ensure competitiveness and revenue optimization.
Risk management	Identification and mitigation of potential economic and financial risks associated with port business and development.	<ul style="list-style-type: none"> Develop and adhere to a comprehensive risk management plan, identifying potential risks and implementing strategies to mitigate their impact. Regularly review and update the risk management plan to address emerging threats and changes in the business environment.

4.4.2. Environmental considerations

Environmental considerations are of paramount importance when incorporating provisions into CAs in ports. These considerations signify a commitment to sustainable practices and responsible stewardship of the surrounding ecosystem. By embedding environmental obligations in CAs, concessionaires are not only acknowledging their role in reducing the environmental impact of port operation and development but also contributing to broader global sustainability goals.

Table 4, as presented below, highlights key sustainability obligations for concessionaires, encompassing critical aspects that can lead to significant environmental benefits. Ultimately, integrating environmental considerations into CAs ensures that concessionaires play a significant role in building a greener, more resilient, and sustainable future for the port and its stakeholders.

Table 4. Environmental considerations for CAs in ports (source: authors, 2024).

Subject area	Description	Obligations for concessionaire
Environmental protection	Protection of water, soil and air quality.	<ul style="list-style-type: none"> Take measures to protect water quality, prevent soil contamination, and mitigate air emissions, ensuring the port’s commitment to holistic environmental stewardship and compliance with existing legislation. Create proactive action plans and monitoring protocols to identify and address potential risks, establishing relevant mechanisms to manage challenges and address problematic areas across all facets of port operations and development.
Environmental initiatives	Focus on environmental sustainability, including reducing greenhouse gas emissions, adopting cleaner technologies, and investing in renewable energy sources.	<ul style="list-style-type: none"> Elaborate and implement an environmental strategy plan. Develop and maintain renewable energy projects for port’s energy needs, contributing to a reduction in the port’s carbon footprint and reliance on fossil fuels.

Table 4. (Continued).

Subject area	Description	Obligations for concessionaire
Energy efficiency	Adoption of energy-efficient practices and technologies to optimize port operations and reduce energy consumption.	<ul style="list-style-type: none"> Optimize energy consumption and minimize energy waste during port operations. Minimize energy waste during port operations. Prioritize energy-efficient port equipment and technologies. Regularly assess energy consumption for continuous improvement. Implement smart technologies for real-time energy tracking and decision-making.
Waste management and circular economy	Emphasis on sustainable waste management, minimizing waste generation, increasing recycling efforts, and adopting circular economy principles.	<ul style="list-style-type: none"> Develop and implement a comprehensive waste management plan. Include specific recycling targets. Minimize waste generation and promote recycling and resource recovery.
Biodiversity conservation	Protection of marine habitats and biodiversity, with measures to preserve nearby ecosystems and wildlife.	<ul style="list-style-type: none"> Implement strategies and measures to minimize the impact of port activities on marine habitats and protected areas. Introduce eco-friendly operational practices to safeguard nearby ecosystems and wildlife. Monitor the health and diversity of local ecosystems. Support conservation programs to protect and enhance biodiversity in and around the port area.
Investment in green infrastructure	Concessionaires required to invest in eco-friendly infrastructure projects, such as electrification of port equipment and shore power facilities for vessels.	<ul style="list-style-type: none"> Invest in green infrastructure projects and electrification. Promote the use of alternative fuels and cleaner technologies. Collaborate with relevant stakeholders to identify additional opportunities for sustainable infrastructure development and resilience of the port.
Monitoring and reporting	Provisions for monitoring and reporting on sustainability performance, tracking progress, and compliance with sustainability goals throughout the concession period.	<ul style="list-style-type: none"> Establish a comprehensive sustainability monitoring and reporting framework, monitoring key sustainability indicators. Implement internal auditing and compliance measures. Ensure accountability and compliance with sustainability commitments.
Collaboration and knowledge sharing	Ports collaborating and sharing best practices for sustainable operations, fostering collective improvement of sustainability standards in the industry.	<ul style="list-style-type: none"> Actively engage in sustainability forums, workshops, and knowledge-sharing platforms.

4.4.3. Social considerations

The social dimension of sustainability in port CAs ensures that port operations contribute positively to the well-being of workers, nearby communities, and society at large. By integrating these social considerations, concessionaires demonstrate a commitment to fostering a positive social impact, promoting worker welfare, as well as to create a more inclusive, equitable, and responsible business environment that supports the well-being and the long-term development and prosperity of the surrounding areas.

Table 5, as presented below, provides a comprehensive overview of obligations for concessionaires concerning social considerations in port operations. Each subject area highlights specific actions that concessionaires should undertake to prioritize fair labor practices, community engagement, cultural heritage preservation, health and safety measures, inclusivity, and ethical business conduct.

Table 5. Social considerations for CAs in ports (source: authors, 2024).

Subject area	Description	Obligations for Concessionaire
Labor standards and welfare	Emphasis on fair labor practices, worker welfare, and skill development.	<ul style="list-style-type: none"> Establish and enforce fair labor policies, ensuring compliance with relevant labor laws and international standards. Provide adequate working conditions. Offer training and skill development programs to enhance the capabilities and employability of the workforce.
Local employment and community benefits	Hiring local workers, promoting job creation, and supporting the community.	<ul style="list-style-type: none"> Actively recruit from the local community, promoting inclusive hiring practices and offering equal opportunities for all applicants. Contributing to the upskilling and employability of the local workforce. Promote social responsibility. Engage in community development projects that address local needs and priorities, fostering social and economic progress in the surrounding areas.
Social impact assessment	Understanding potential social impacts and mitigating negatives.	<ul style="list-style-type: none"> Assess potential social impacts and opportunities associated with port operations. Enshrine that the port's operations contribute positively to the well-being of the surrounding communities.
Community consultation and engagement	Involving communities in decision-making and planning processes.	<ul style="list-style-type: none"> Engage with local communities, stakeholders, and non-governmental organizations through transparent and inclusive consultation mechanisms. Consider community perspectives when planning and implementing port projects, acknowledging and addressing their aspirations.
Port-city relationship	Promoting a symbiotic connection, encompassing economic, social, and environmental interactions for mutual development and coexistence	<ul style="list-style-type: none"> Formulate strategies and measures to achieve seamless integration of port operations and development within the city, optimizing land use while minimizing adverse externalities and disruptions. Enhance positive city-port interaction by embracing initiatives such as opening up the port to the city, fostering accessibility, public engagement, and cultural activities.
Cultural heritage preservation	Protecting historical sites and respecting local cultural heritage.	<ul style="list-style-type: none"> Undertake cultural heritage assessments to identify significant sites and traditions, ensuring their preservation during port operations. Develop and implement measures to minimize the impact of port activities on cultural heritage, adhering to guidelines and protocols for respectful engagement with culturally sensitive areas.
Health and safety measures	Ensuring health and safety for workers and nearby communities.	<ul style="list-style-type: none"> Establish and enforce robust health and safety protocols, conducting regular training sessions to promote a culture of safety among port personnel. Develop comprehensive emergency response plans to handle potential accidents and incidents effectively, mitigating risks to workers, communities, and the environment.
Inclusivity and diversity	Promoting workforce diversity and equal opportunities.	<ul style="list-style-type: none"> Implement policies to promote diversity and equal opportunities in hiring and professional advancement, ensuring a supportive and inclusive work environment for all employees. Encourage the recruitment and advancement of women and minority groups in roles traditionally underrepresented in the industry, fostering a more diverse and resilient workforce.
Human rights and ethical practices	Upholding human rights and ethical business conduct.	<ul style="list-style-type: none"> Establish and enforce policies that respect and protect human rights within the port's operations and across its supply chain. Promote transparency and ethical behavior in all aspects of the port's business. Regularly monitor and assess the effectiveness of human rights and ethical practices.

4.5. Obstacles and enablers

Table 6, as presented below, highlights possible obstacles and enablers for the conceding authorities and concessionaires to effectively integrate sustainability provisions in CAs and foster a sustainable and responsible port industry. It encompasses the diverse challenges and opportunities that each party may encounter during the process. The table concisely outlines critical factors, such as awareness, financial capacity, regulatory framework, stakeholder participation, data availability, and capacity and expertise, while proposing relevant enablers for addressing these obstacles. It is stressed that each factor holds its own importance and can influence sustainability outcomes in CAs in different ways. By highlighting both the obstacles

and enablers, the table recognizes the complexity of the process and the potential opportunities for progress in each area. It underscores the need for a holistic and collaborative approach, considering multiple dimensions of sustainability, to ensure successful outcomes and positive impacts on port operation and development, as well as on and surrounding communities.

Table 6. Obstacles and enablers for sustainability provisions in CAs (source: authors, 2024).

Factors	Conceding authorities		Concessionaires	
	Obstacles	Enablers	Obstacles	Enablers
Awareness	Lack of awareness and understanding	Strong commitment to sustainability	Lack of awareness and understanding	Acceptance of sustainability goals and initiatives
Openness and willingness to change	Resistance to change and inertia	Demonstrated success stories of sustainable ports	Traditional business culture, limited previous sustainability record	Success of sustainable practices in other projects, competition
Financial capacity	Short-term financial pressures	Long-term vision for sustainable port development	Limited financial resources	Long-term vision for sustainable business growth
Support	Lack of knowledge and experience or support	Knowledge sharing and technical assistance	Limited access to sustainable technologies and financing	Collaboration with sustainable technology providers and green financiers
Regulatory framework and policy	Unclear or non-supportive regulatory framework, lack of enforcement, policy constraints	Supportive sustainability policies and regulations	Reluctant compliance	Compliance with sustainability regulations and standards
Stakeholder participation	Conflicting priorities, non-participatory processes	Transparent and inclusive stakeholder engagement	Limited experience with stakeholder engagement and participation	Stakeholder engagement and communication on sustainability efforts
Data and information	Lack of data and information on sustainability performance	Availability of data and information on sustainability performance	Lack of data and information on sustainability performance	Establishment of sustainability metrics and reporting systems
Environment and capacity	Political and governance challenges	Stable political environment and strong governance	Insufficient capacity and expertise for sustainability planning and implementation	Sufficient capacity for sustainable port operations and development

5. Discussion

Despite sustainability considerations having gained significant prominence in the discourse and strategic planning of port operation and development, it is noteworthy that CAs in ports may not consistently encompass pertinent provisions. Even in cases where such provisions are present, they often remain relatively general or abstract in nature, lacking substantial obligations for the parties involved and offering limited potential for producing tangible outcomes. Consequently, the actual impact of these provisions is negatively affected, and their ability to drive meaningful progress toward sustainability goals is constrained.

Port authorities, municipalities or states are reluctant to push for sustainability provisions, because they do not want to scare off investors interested in the ports/port business and potential concessionaires are not willing to accept far-reaching obligations. The real concerns of both sides are the subject matter of the concession, the financial part of the deal and the economic terms of the concession, while some terms are linked with planned investments or output-based specifications to be evaluated by key performance indicators, e.g., a certain minimum throughput per year.

Environmental considerations are included to the extent that relevant obligations stem directly or indirectly from existing environmental legislation, as also shown by Notteboom and Lam (2018), Notteboom and Verhoeven (2010). They are kept to a necessary minimum level reflecting a rather defensive approach. The same goes also for social considerations, opting usually for a very low ambition scale and in any event clearly disproportionate to the subject matter and the attributed significance of the concession. In general, the qualification of candidates for the bidding process during a concession primarily relies on established business experience, technical solvency, and financial strength, while sustainability criteria often receive limited attention. If considered, sustainability factors tend to become relevant during the selection stage among various other criteria, but their influence does not appear to be decisive (Pallis et al., 2015).

The port sector is currently experiencing significant transformative pressures, compelling a shift toward sustainability. The social acceptance of port operations and development, as well as the establishment of a harmonious relationship between the port and its host community, hinges heavily on the proactive adoption and implementation of sustainable strategies by port authorities. Moreover, the industry recognizes the substantial advantages inherent in embracing sustainable transformation for port operations and development. Concurrently, there is a growing acknowledgment of the escalating costs associated with maintaining a “business as usual” approach, resonating with all stakeholders. As a consequence, there is a prevailing expectation of a paradigm shift in the medium and long term, which is very likely to be reflected in future CAs. The waning resistance against robust environmental and social provisions in CAs will probably facilitate negotiations for more sustainable terms by port authorities, municipalities, or states. The momentum of the sustainable development paradigm will persist, generating a positive dynamic that reinforces progress toward sustainable port operations and development. Amidst these transformative forces, the industry is poised to witness considerable advancements on the path toward enhanced sustainability and the realization of more responsible and holistic port practices.

Among the most important drivers of change, the following are identified:

- Strong environmental pressures that may prompt demand for more ambitious strategies and policy measures.
- Vulnerability to environmental risks and awareness of these risks.
- Normative pressure from existing legislation or other obligations.
- Public pressure from local communities for a harmonious port-city relationship.
- Mainstreaming of sustainable development and SDGs in national transport policies.
- Enhanced political commitment for sustainable solutions, sustainability rhetoric, and gradual support by political elites.
- Potential and opportunities for structural change, modernization, rationalization, and business profitability in the sector.
- Gradual inclusion of actors/stakeholders and public into policy design and implementation.

These drivers of change and their interaction are expected to reshape the landscape for CAs and revolutionize their content and negotiation in the short to

medium term. It is logical to assume that CAs, as a framework capturing the intentions of the parties involved, will adapt to a new reality in the sector and incorporate sustainability as an integral part of new approach of port operation and development.

Port concession agreements, acknowledged early on as significant port governance tools (Notteboom, 2006), pose a critical governance challenge in the maritime sector, with the inclusion of sustainability provisions becoming increasingly imperative. Establishing a comprehensive public policy framework that explicitly integrates environmental and social dimensions within these agreements is paramount for securing maximum benefits for all stakeholders. Traditionally, concession agreements focused predominantly on economic considerations, neglecting the broader societal and environmental impacts of port operations. However, the emergence of sustainability as a core component signifies a transformative trend, reshaping the governance dynamics of the port industry. Evolving templates and guidelines, as well as legal texts such as the EU Concession Agreements Directive, reflect a progressive paradigm shift. Public policy is confronted with a new reality, acknowledging the integral role of sustainability in the port industry. The emergence of this trend emphasizes the importance of aligning governance practices with contemporary environmental and social expectations. State entities, international organizations, port authorities, and stakeholders must recognize this as a governance challenge, necessitating innovative solutions that will have substantial and enduring impacts on the sector. As governance frameworks gradually adjust to encompass sustainability dimensions, a fundamental redefinition of the roles and responsibilities of all parties involved is most likely to occur. Proactively addressing these issues is essential to promote sustainable port development and ensure the achievement of pertinent environmental and societal goals. In light of the above, questions such as who governs and what is governed in port governance (Zhang et al., 2018), as well as how to govern and for what purpose (Zhang et al., 2019), need eventual reconsideration. The landscape of port governance is expected to evolve into a more intricate, multifaceted, and collaborative structure involving multiple stakeholders, guided by overarching principles and diverse concurrent goals. This evolution will notably manifest in CAs in ports, reflecting the dynamic nature of this field.

6. Conclusion

This paper has conducted a thorough investigation of CAs in the context of advancing sustainability within port operations and development. By integrating the economic, social, and environmental pillars of sustainability, alongside all pertinent variables, the paper aimed to contribute significantly to the scholarly discourse on achieving sustainable business models and prospects in ports through concessions. Moreover, the research sought to advance our understanding of the subject matter while laying the foundation for an innovative CA framework model, providing an adequate, flexible and adaptable tool in subsequent stages. This envisaged framework could enable the state (public policy) and/or port authorities, port terminal operators and port services providers (port industry) to make rational and sustainable choices on the necessary provisions to be included in such agreements. By offering a structured approach, the model aims to transcend high-level discussions and address the practical

intricacies of integrating sustainability into the operational fabric and development of ports. As we move forward, the development and implementation of this framework hold promise for engendering enduring sustainability practices within the port industry, aligning with the evolving public policy and industry needs.

Acknowledging the current evolving landscape, the paper emphasizes an increasing trend towards incorporating concrete provisions for sustainability in CAs within the port industry. This shift is driven by the growing recognition of sustainability's significance. Future CAs are expected to feature more specific and enforceable provisions aimed at promoting sustainability and fostering environmentally responsible and socially inclusive port operations and development. Moreover, to ensure the selection of concessionaires aligned with sustainability goals, port authorities are likely to elevate importance of sustainability-related awarding criteria. This would enable the prioritization of concessionaires with a proven track record in sustainable port management and development, as well as those demonstrating commitment to addressing environmental and social considerations. Additionally, there may be a focus on concessionaires whose proposed strategies align with the port's long-term sustainability objectives. Depending on the concession notice describing of the concession and the conditions of participating in the concession award procedure, sustainability clauses could even lead to the exclusion of interested parties with no previous experience with sustainability and a less convincing proposal with regard to sustainability. However, it is crucial to emphasize that, even though this is the likely trajectory, the inclusion of environmental and social aspects in CAs will present considerable challenges due to various potential obstacles. Maneuvering the integration of environmental and social considerations into CAs poses significant challenges for both states and port authorities, as well as concessionaires. These challenges may materialize in different forms, including hesitancy in prioritizing sustainability, tough negotiations, and the potential for suboptimal solutions and outcomes that may compromise sustainability provisions. Successfully addressing these hurdles requires a shared perspective on the merits of sustainability, broader consensus, coordinated efforts, and collaborative strategies from all parties involved.

As the role of CAs in the port sector continues to gain significance, there is a compelling need for sustained and heightened attention to scientific research. Future research endeavors should adopt a multifaceted approach, incorporating various methodologies to advance our understanding and practical implementation of sustainability in CAs. In-depth case studies, examining specific CAs within diverse port contexts, will provide nuanced insights into the real-world implications of sustainability provisions and serve as invaluable foundations for comparative analyses. These case studies will not only highlight the effectiveness of certain sustainability measures but also underscore the importance of considering unique contextual factors. Comparative analyses, considering different regulatory frameworks and socio-economic conditions, will deepen our understanding of contextual nuances influencing the effectiveness of sustainability measures. A focused examination of key performance indicators (KPIs) associated with sustainability provisions will offer a quantitative assessment of their impact, ensuring a granular understanding of measurable outcomes. Moreover, dedicated research on the intricate

relationship between port operation, development, and public policy will be instrumental in advancing sustainability in the port industry. Emphasizing specific aspects, such as stakeholder engagement, financial viability, and environmental impact assessments, within the context of sustainability in CAs, will contribute to a more nuanced understanding. Encouraging interdisciplinary collaboration and active involvement of industry stakeholders in the research process will enhance the practical applicability of findings. By refining the proposed model framework for CAs through iterative testing in diverse port scenarios, researchers can develop a more robust and universally applicable tool. In essence, this concerted scientific engagement holds the potential to shape the future of sustainable practices in the port sector, fostering meaningful impact and enduring sustainability. The authors hope that this research will intrigue further interest and inspire additional investigations.

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