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Toward Realization of the United Nations' Sustainable Development Goals**

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Article

Cruising Under and Post the COVID Pandemic: Toward Realization of the United Nations' Sustainable Development Goals

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Abstract: Maritime sectors have always dealt with uncertainties and disruptions. The COVID pandemic confronted the cruise industry with profound, wide-ranging, and lasting challenges while disrupting normal operations. Although the cruise industry contributes to the implementation of the United Nations Sustainable Development Goals (UN SDGs), resumption and sustainable cruising requires the industry to adapt to the challenges presented. To this end, the paper suggests adaptive actions for the cruise sector to respond to the pandemic and links the actions to the UN SDGs to highlight their sustainable contributions. A system thinking approach is applied and a literature review is conducted to identify suitable adaptive actions. This paper shows the importance of UN SDGs 3, 4 and, in particular, 17 for sustainable cruising. The results of this paper provide support for informed decision-making to increase the cruise industry's sustainability. This paper recommends that stakeholders: 1- identify drivers and barriers of sustainable cruising, 2- adapt to changes and embrace the UN SDGs, as they provide a platform for realizing sustainability, and 3- use educational programs to improve and transfer knowledge on sustainable cruising between academia and policymakers.

Keywords: cruise sectors; COVID pandemic; sustainability; United Nations Sustainable Development Goals (UN SDGs)



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1. Introduction

With a growth rate of about twice the growth rate of land-based tourism, the cruise industry was the fastest-growing segment in the travel industry before the COVID pandemic. The COVID pandemic has had a profound impact on maritime sectors (e.g., ports, shipping, and terminal operators) and it was a major disruption not only for maritime transportation but also throughout the supply chain [1]. In this context, Jin [2] pointed out the severe fluctuations and drop in demand and supply of countries' international liner shipping [2].

The shipping industry (dry bulk shipping, tanker shipping, liner (container) shipping, cruise) has been affected by the COVID pandemic to different degrees. The liner shipping industry was able to quickly adjust supply to demand [3]. However, the cruise industry (i.e., cruise liners (or cruise operators), cruise ships, cruise ports, port cities), and to a smaller extent on ferry vessels [4], has been impacted the most due to widespread disruptions that led to the complete cessation of operations [5].

Although the cruise industry has shown resilience in the face of crises [6], the impacts of COVID are more severe than any other disruptions in the past, demanding structural and transformational changes. In addition, the steady growth of the cruise industry comes with ever-increasing concerns about its adverse environmental (e.g., [7]) and social (e.g., [8]) impacts which can pose pressures on destinations, affecting social perceptions and concerns.

Growing cruise activities can also result in infrastructure costs at the tourism destinations (i.e., port and surrounding town/city or community) since they are on the schedules of the major cruise lines [9]. In this context, the long-term sustainability of the cruise industry and the realization of the United Nations' Sustainable Development Goals (UN SDGs) call for a thorough and balanced policy.

To mitigate the effects of disruptions in the maritime industry, ship schedule recovery strategies should be implemented [1]. Therefore, there is an imperative need to not only mitigate, recover and resume cruise calls in the post-pandemic world but also increase the preparedness and resilience of the cruise industry aiming at ensuring business continuity and sustainable cruising post COVID, yet in the shadow that COVID could re-appear.

To enhance the resilience of the maritime sectors and to maintain their competitive position, adaptive strategies (or a set of adaptive actions) are required to be taken while keeping in line with the UN SDGs [2]. Dulebenets [10] proposed that innovative and effective alternatives should be explored to ensure sustainable development of maritime transportation and meet the long-term IMO targets [10].

This research contributes to the literature advancing knowledge on sustainable cruising post the pandemic. In comparison with other publications that overview the state of the global cruise industry impacted by the COVID pandemic, this study is broader and aggregates a comprehensive list of actions for the cruise industry including cruise liners, cruise ships, and cruise ports, and port cities.

Adaptive actions are aggregated from the existing literature to respond to pre-existing challenges in the cruise sector and for those yet to come. This information is intended to help stakeholders to prepare or enhance management strategies to deal with the aftermath of the pandemic and prepare for a possible re-occurrence of the pandemic. The expected re-growth of the industry presents an opportunity for port stakeholders and policymakers to together devise new actions leading to new policies for sustainable cruising in the future [11]. The knowledge of challenges that the cruise sector needs to address, learn, and evolve from the COVID pandemic is vital for sustainable cruising.

The actions are linked to the UN SDGs. This linkage assists policymakers to better understand the contribution of the actions to the UN SDGs, define sustainability measures, and formulate strategies for future cruising in a sustainable manner. Furthermore, it facilitates effective stakeholder engagement based on the selected and or prioritized actions concerning the UN SDGs to increase the sustainability of cruising.

As stakeholders have different interpretations of the UN SDGs [12], they should work together to achieve mutually beneficial outcomes. Effective and collaborative agreements amongst stakeholders are essential for sustainable maritime transportation [10]. In this context, researchers play a key role to facilitate understanding of the process and provide support with suitable solutions for informed decision making.

This paper is structured in five sections: Section 2 reviews the literature on the impacts of the COVID pandemic on the cruise sector; Section 3 characterizes the methods to provide adaptive actions; Section 4 highlights the contributions of the cruise sector as well as the adaptive actions to the UN SDGs and then discusses the findings; Finally, Section 5 presents concluding remarks, the limitations of this research, and the recommendations for future research.

2. Literature Review

The cruise industry in recent years became one of the most dynamic segments of international transportation and tourism and experienced significant growth. Cruise ships have become more than just a mode of transport due to the amount of time that passengers spend onboard and Xu et al. [13] pointed out that cruise ships themselves have become the destination. This growth has affected the industry with more vessel deployments, an increase in size and capacity, longer and more diversified itineraries [14], and calls to unvisited and less-frequented ports [15]. Furthermore, demographic and

geographic expansion of passengers and market sources have continuously been sought by cruise liners [16].

In 2019, passenger ships constituted more than half (i.e., 55%) of port calls worldwide. The Cruise Lines International Association (CLIA) stated that from 17.8 million in 2009, cruise ship passengers have grown to 30 million in 2019 at an annual growth rate of 5.4%, and 32 million was expected in 2020. In 2019, European cruise ports hosted 28.4% of the capacity deployed worldwide, with 7.5 million passengers. Before the onset of the COVID pandemic, the cruise industry was an important contributor to the global economy, with 1.1 million employed people worldwide [17].

In February 2020, the COVID outbreaks were reported on cruise ships, introducing novel challenges for the cruise sectors. In March 2020, the World Health Organization (WHO) declared an international pandemic, and the social and economic consequences of the pandemic spread globally. The unprecedented pandemic was followed by national lockdowns and strict travel restrictions. In April 2020, the U.S. Centers for Disease Control and Prevention (CDC) issued a “no sail order” and following that ocean cruising came to a total standstill.

The cruise sector has experienced and coped with the 2001 terrorist attacks (i.e., 9/11), the 2002 SARS epidemic, the 2008 global financial crisis, and the H1N1 2009 Influenza pandemic. However, the COVID-19 pandemic has had the largest impact, in terms of size and consequences, on the cruise industry to date. Other maritime sectors were also impacted, but the trade did not stop to ensure the movement of goods [18]. The impacts on the cruise sector have been a subject of avid research in terms of economic impacts (e.g., [19]), social impacts (e.g., [20]), and environmental impacts (e.g., [4]). The topic is discussed globally, and research activities are not concentrated in a country/region/continent. The major impacts are discussed below.

The COVID pandemic has not only influenced consumer behaviors for cruising [20] but also seriously affected tourism-driven countries [18]. The European Maritime Safety Agency (EMSA) stated that Iceland, Croatia, France, and Spain were the most affected European countries in terms of a decrease in the number of cruise ship calls [21].

Furthermore, perceived risk is a significant factor influencing destination choice [22]. People feel safer when they travel to countries (or ports) that might have fewer risks of infection than other countries (or ports) [23]. Sharpley [24] stated that islands have been attractive destinations due to their unique environment and climate characteristics. Small ports in (small) islands may provide safer service in a pandemic but do not meet the requirements of large cruise ships with a large number of passengers, and small ports need adaptation to accommodate cruise ships. This adaption can be ranged, for instance, from providing new services to infrastructure development.

The cruise industry has promoted strategies to rebuild trust, attract customers, and resume cruising. Impacts of the pandemic on the financial loss, health, and infection control onboard are well studied (e.g., [25]). During a pandemic, infrastructure as a factor to increase the attractiveness of ports [15] may not be sufficient, whereas providing specific services and procurement needs play a crucial role [26].

The maritime industry can potentially contribute to UN SDGs [27]. Christodoulou [28] stated that the focus of the industry is on certain UN SDGs related to maritime safety and security, marine pollution, marine environment, and technical cooperation [28]. Literature suggests that cruise liners and ports can contribute to the implementation of the UN SDGs [29] and Di Vaio et al. [11] provide an overview of relevant literature.

Understanding a system’s performance before, during, and in the aftermath of disruption is required for planning, mitigation, and sustainability [30]. EMSA [31] emphasized the gradual and safe resumption of cruise ships operations in the European Union during and post the COVID pandemic in a socially, economically, and environmentally manner [31]. A core priority of the International Maritime Organization (IMO) is the global partnership for sustainable development (UN SDG #17) [28]. The sustainable development of maritime

and shipping industries is significant for meeting the IMO-led strategy on sustainable development within the context of the 2030 Agenda [32].

Systems thinking and adaptive and sustainable strategies are vital for successful cruising in the shadow of the pandemic.

3. Methods

In this paper, several methods are synthesized to ensure rigorous investigation of the existing data and information. A robust exploration and interpretation of the information unfolded adaptive strategies for sustainable cruising post the pandemic.

3.1. System Thinking

System thinking forms the basis of the proposed approach that can be applied for cruising during and after the pandemic. The system thinking approach, which is in contrast to the reductionist approach, is defined as thinking of the whole rather than focusing on the properties of individual elements and how they interact [33]. System thinking helps to understand how a system can react to the implementation of a certain strategy. In this approach, phenomena are understood to be an emergent property of an interrelated whole. The approach is commonly used for thinking about real social systems. System thinking can be used as a grounding for action research to explore, identify, and solve a problem. Action research is carried out to construct practical conclusions that resonate with the experiences about the system [33]. Therefore, to plan effective actions, system thinking is a useful approach for this paper, sustainable cruising during and after the COVID pandemic.

This paper conducts qualitative research based on secondary data research. Secondary data research allows for the collection of already existing data from several different sources and helps to identify important information that has not been addressed through previous research (i.e., research gap) [34]. In this study, to collect secondary data, a literature review is conducted. The review of literature aids in a deep understanding of the topic under study and is required for data and information analysis [32]. Different policy documents, scholarly articles in peer-reviewed literature, official reports, and statistics related to the impacts of the COVID from various government websites were reviewed.

This approach provides a comprehensive source of information about the topic under study to identify gaps and make decisions/arguments to address them. For secondary data analysis, the content analysis method was used. The content analysis approach is widely used for data and information gathering [27]. Using this method as a research tool allows us to understand and interpret textual material and graphics, elicit meaning from them, and draw realistic conclusions [35].

The two main web search engines used were the Clarivate Web of Science and Google Scholar. The criteria for selecting papers were: (1) papers and reports published in the English language and (2) papers that mainly dealt with the cruise industry, UN SDGs, and COVID-19. Thus, these keywords (i.e., cruise industry, UN SDGs, and COVID-19) were used to search for relevant papers. The identified papers were published in journals from around the world, covering a wide range of disciplines, and not only focusing on the cruise industry, UN SDGs, and COVID-19. As the majority of the references used in this study are peer-reviewed papers and published reports from national and international authorities, the accuracy of the collected information is expected to be at an acceptable level. The reference list includes the cited sources.

3.2. Planning Adaptive Actions

The system thinking approach emphasizes that human thought is not capable of knowing the whole [33]. Therefore, in the context of uncertainty and complexity, introducing adaptive actions to deal with uncertainties (i.e., opportunities and vulnerabilities) over time increases the success of a plan [36]. The actions either seize opportunities or manage vulnerabilities to protect the plan against failures. To manage vulnerabilities derived from uncertainties (i.e., COVID pandemic), prepare the organization (i.e., cruise industry) against

failure, and thus provide decision support, required actions should be taken into account. Taneja [28] distinguished efficacious actions to deal with opportunities and vulnerabilities in port planning. The actions are derived from Assumption Based Planning (ABP) [37] and Adaptive Policy Making (APM) [38,39]. These approaches rely on dealing with future uncertainties through planned adaptation, i.e., preparing actions either in the planning stage or by preparing actions in advance that can be taken if an uncertain future materializes, in response to triggers from a monitoring system that monitors the external environment for unexpected developments and alerts planners for the need to modify or reassess plans. The actions are mitigating, hedging, shaping, and seizing actions. Mitigating actions are in response to fairly certain vulnerabilities and to reduce their potential adverse effects. Hedging actions spread and reduce highly uncertain adverse effects of vulnerabilities. Shaping actions affect certain and uncertain vulnerabilities to change their nature, prevent their development, and direct them towards a preferred plan. Seizing actions take advantage of fairly certain opportunities.

The results provide adaptative strategies for the cruise industry (i.e., various stakeholders) aimed at sustainable cruising under and post the COVID Pandemic.

4. Results and Discussion

4.1. Contributions of the Cruise Industry to the United Nations Sustainable Development Goals (UN SDGs)

The UN SDGs (Table 1) aim to be a globally used guideline for social, economic, and environmental improvement. Some goals mainly focus on society (e.g., # 1–5, 7, 10, 16, 17), while some focus on the environment (e.g., # 6, 13–15), and others are relevant to the economy (e.g., # 1, 8, 10). The cruise sector can play a role in enhancing many of the goals. Table 1 indicates the potential contributions of the cruise sector to various UN SDGs; the extent of contribution depends upon the willingness of the sector parties and the cooperation of other stakeholders.

Table 1 shows considerable contributions of the cruise sector to the UN SDGs. The United Nations World Tourism Organization (UNWTO) pointed out that tourism can contribute to all UN SDGs [40]. In this context, Di Vaio et al. [11] pointed out the contribution of cruise liners and cruise ships to the UN SDGs. Indeed, the cruise industry has undertaken notable actions to (directly or indirectly) contribute to the UN SDGs.

As mentioned in Section 2, the cruise industry is a major player in the world economy and fosters economic growth and development by creating jobs at all levels, onboard (e.g., engine rooms, cabin stewards, gallery stewards), in ports (e.g., port dues, utility costs), and in cities (e.g., taxis, souvenirs, shore excursions, attractions [41]). Maritime companies are committed to raising safety awareness and safety culture, periodical inspections, and risk assessments to identify potential safety hazards [27]. Tourism is increasingly recognized as a vital contributor to poverty alleviation by generating trade opportunities, entrepreneurship, and empowering host communities. In this vein, women can become fully engaged in tourism and hospitality-related enterprises (UN SDG #1, #5, #8) [40].

Cruise ports and cities are important parts of sustainability in the cruise industry [42]. However, harm to the environment [7], a decrease in air quality [43], and (over)crowding of ports and cities [44] have increased the concerns. To increase tourist satisfaction and improve the quality of life (UN SDG #3), the industry should be ecologically sustainable [45].

Cruise liners, in partnership with UNICEF, raise funds and develop a range of humanitarian actions, for instance, to underprivileged communities and are faced with natural disasters in collaboration with international organizations and NGOs (SDG 16) (UN SDG #6, #10, #16) [11]. Furthermore, they provide various onboard cultural and educational programs and various training activities (UN SDG #3, #4) [40].

Energy efficiency and decreasing environmental footprints (UN SDG #7) are taken into consideration by ports, for instance, clean energy for shore-based offices and terminals [27], and cruise ships through innovative solutions (UN SDG #9) [46].

Viable port infrastructure is critical to safely accommodate cruise ships and handle the significant strain that they place on the port due to their short turnaround time and the large number of passengers (UN SDG #9).

Table 1. Potential contributions of the cruise sector to the United Nations’ Sustainable Development Goals (UN SDGs) (<https://sdgs.un.org/>, accessed on 1 February 2022).

No.	UN SDGs	Cruise Sector Parties			
		Cruise Liners	Cruise Ships	Cruise Ports	Port Cities
1	End poverty in all its forms everywhere	X			X
2	End hunger, achieve food security and improve nutrition and promote sustainable agriculture	X			X
3	Ensure healthy lives and promote well-being for all at all ages	X			X
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	X		X	X
5	Achieve gender equality and empower all women and girls	X		X	X
6	Ensure availability and sustainable management of water and sanitation for all	X			X
7	Ensure access to affordable, reliable, sustainable and modern energy for all	X		X	X
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	X	X	X	X
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	X		X	X
10	Reduce inequality within and among countries	X			X
11	Make cities and human settlements inclusive, safe, resilient and sustainable	X			X
12	Ensure sustainable consumption and production patterns	X	X	X	X
13	Take urgent action to combat climate change and its impacts	X	X	X	X
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development		X	X	X
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	X		X	X
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	X			X
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	X	X	X	X

The circular economy, onboard recycling practices (e.g., using recycled materials, waste reduction and treatment), energy-saving technologies, operational efficiency systems, and innovative solutions to recover and reuse energy on board, therefore reduce fuel consumption and emissions (UN SDG #12) and are increasingly utilized by the cruise sector [11,47].

Cruise ships comprise less than 1% of the global maritime community but follow EU Directives (i.e., 1999/32/EU, 2012/33/EU, 2014/94/EU, 2016/802/EU) and are pioneers to reduce emissions and environmental impact by technological developments and alternative fuels (UN SDG #7, #13). Air pollution and particle emission reduction are one of the priorities of CLIA ocean-going cruise lines and they have adopted technologies and practices such as Exhaust Gas Cleaning Systems (EGCS), renewable energy and alternative fuels Liquefied Natural Gas (LNG), shoreside power, special paint coatings for ship hulls, stringent air emissions requirements in Emission Control Areas (ECAs) and the 2020 Global Sulfur Limit outside of ECAs [11,48]. Furthermore, the World Ports Sustainability Program

(WSP) supports ports with sustainable solutions, for instance, providing renewable energy sources, vessels, means of transport, and accommodation sectors.

In comparison to other means of transport, the maritime industry has the least environmental impact and in the tourism sector, the cruise industry is the leader in environmental stewardship [49]. Cruise liners account for the IMO role in the ballast water management convention [50], and the International Convention for the Prevention of Pollution from Ships (MARPOL). CLIA cruise line members have undertaken notable actions for positive impacts on the environment. They are committed to wastewater (e.g., water treatment), discharge (e.g., waste), and pollution (e.g., noise) management, protecting maritime ecosystem (wildlife and biodiversity) (UN SDG #14) [46]. In this vein, Pakbeen [51,52] and [40] presented the major contributions of cruise ships to UN SDG #14.

CLIA [46] stated that cruise liners have made significant contributions to protecting, conserving, and restoring the natural (coastal ecosystem [27]) and cultural heritages (which is one of the main reasons for attractiveness and visiting of destinations) (UN SDG #14, #15, #16) by relevant practices and policies, and support communities at ports of call, for instance, rural, urban, and port renewal and development, public services (e.g., health care, education, restaurants, shops), and utilities (water access and hygiene, and security for more peaceful societies) by revenues and tax income generated from tourism (UN SDG #11). In this context, UNWTO [40] pointed out that tourism can promote the sale and use of local agricultural products at tourist destinations (UN SDG #2). This enhances the value of tourism, increases the support of the local community, and thus the industry gains social license to operate.

Nevertheless, the growing number of cruise passengers poses environmental and social challenges for some cruise tourism destinations. In this context, the cruise industry must use interlinkages between its sectors, strengthen their dialogue with each other, and develop national and international cooperation and communication with stakeholders (UN SDG #17). The industry is required to develop, implement, and enforce effective tools and processes that ensure compliance with international conventions, codes, and guidelines and which are in line with local rules and regulations. Each sector may start by focusing on its area of business (using ad hoc solution) aiming at gradually moving the cruise industry toward UN SDGs [27].

To meaningfully contribute to the UN SDGs, effective communication and cooperation of cruise sector parties and policymakers along with (interdisciplinary) research and development are essential (UN SDG #17). Furthermore, transparent and complete information through annual sustainability reports by cruise sectors, collection of general visitor criteria, and their vacation behavior are crucial to strategically developing and managing a sustainable cruise business. In this context, cooperation with individual researchers and collaboration with research projects to measure sustainability performance, evaluate existing policies and practices, and identify gaps, determine sustainability initiatives and innovative practices is crucial. This aids the development of a proactive response (instead of a passive response) to challenges, and thus facilitates a sustainable future for cruise tourism destinations including a well-functioning society, a healthy environment, and a stable economy.

The cruise sector has contributed to the UN SDGs through initiatives that protect the environment, support communities, and create economic prosperity. However, sustainable cruising during the COVID pandemic and in its aftermath requires initiating actions to respond to the new challenges which the cruise sector has faced.

4.2. Adaptive Actions for Cruising during the COVID Pandemic and in Its Aftermath

Although the UN SDGs (Table 1) are used as a guideline in businesses and policy-making processes, reaching the UN SDGs is challenging due to multiple policy arenas. Researchers and scientists have the responsibility to provide data, information, guidance, and required solutions (or actions) to support the decision-making process. Adaptation to new or changing conditions is required to reach the UN SDGs.

Adaptation at different layers of the cruise industry (i.e., cruise liners, cruise ships, cruise ports, port cities) should be accounted for [52]. This is because these sectors are interconnected and the increase in the sustainability of one sector may depend on the sustainability of other sectors. In other words, the sustainability of the cruise industry after the pandemic cannot be only related to the port itself (e.g., port infrastructures) and a holistic approach along with the entire industry (i.e., cruise liners, cruise ships, cruise ports, port cities) is required.

In this study, actions are planned for four cruise sector parties (categories of the cruise industry). These are cruise liners, cruise ships, cruise ports, and port cities. Table 2 lists the adaptive actions that can be taken by these cruise sector parties in response to the COVID pandemic and its aftermath, and they shed light on their contributions to the UN SDGs.

A system (i.e., the cruise industry in this paper) is organized by a set of elements (i.e., cruise liners, cruise ships, cruise ports, port cities in this paper) that are coherent and interconnected in a way to achieve the desired purpose. The promise of the systems thinking method is its capability to address transdisciplinary or complex problems (e.g., economic, social) [66]. This paper showed that the systems thinking method is a useful approach for understanding how to deal with problems and or manage changes. It can meaningfully help policymakers to have a better knowledge of dealing with challenges for sustainable cruising during and post-COVID Pandemic. Through the application of the systems thinking approach, several adaptive actions were identified.

Table 2. Adaptive actions for cruising post pandemic and their link to the UN SDGs.

Cruise Sector Parties	Actions	Description	UN SDGs
Cruise liners	Shaping	Provide new options with a larger and more diversified range of ships to generate demand for cruises [53], as arrival and departure ports as well as the size of the cruise ships can affect the COVID infection rate [6].	3, 8, 12
	Mitigating	Collect passenger information before boarding and re-embarking for contact tracing on board. Carry out pre-boarding screening to defer or reschedule infected people while needed [18].	3
	Mitigating	Improve health, safety, and security aspects (e.g., information sharing by maritime stakeholders, training and education) [54].	3, 4, 17
	Mitigating	Follow technical instructions presented by CDC or relevant agencies for the establishment of agreements with ports to ensure the necessary infrastructure for managing COVID as needed. Based on this instruction, conduct simulated voyages to allow ship crews and port personnel to practice new operational procedures before sailing with passengers [55].	3, 4, 9, 17
	Hedging	Plan to spread cruise ship calls at a port over an extended season and include winter cruise calls, limit the size and frequency of ship, and call to safe ports [13].	3, 11, 17
	Hedging	Reduce the number of cruise ships at a port and deploy ships across several ports [26].	3, 11, 17
	Mitigating	Offer travel within passengers’ countries [23].	3, 11
	Hedging	Increase the flexibility of vessels’ deployment based on the quality and quantity evaluation of port services. Prolong engagement and commitment to ports to safeguard their development plan [9].	3, 17
	Mitigating	Manage space and social interactions on the ships [20].	3

Table 2. *Cont.*

Cruise Sector Parties	Actions	Description	UN SDGs
Cruise ships	Mitigating	Educate and update passengers with new information to protect themselves and others on board and avoid spreading infection as introduced by Silva [18].	3, 4
	Mitigating	Apply CDC’s framework before sailing to ports and account for the World Travel and Tourism Council’s global safe travel protocols [56].	3, 4, 8, 17
	Mitigating	Follow the 74 recommendations in 25 different areas of the Healthy Sail Panel [57].	3, 4, 17
	Mitigating	Apply the guidance and recommendation of pre-boarding, onboard disembarkation, and re-embarking in the European Union for a gradual and safe resumption of operations [31].	3, 4, 17
	Mitigating	Promote resilience by risk assessment, outbreak plan, high health protocols, good communication plan, increase in technology and digitalization, improve the state of medical preparedness to handle severe medical conditions onboard and to rely less on ground-based facilities, implement mandatory health insurance for staff and customers [58], and provide personal protective equipment [59].	3, 4, 9, 17
	Mitigating	Follow the risk mitigation plan as introduced by Brewster et al. [60].	3, 4, 17
Cruise ports	Shaping	Arctic destinations face particular challenges in managing cruise tourism due to their remoteness, harsh environment, and unpredictable weather conditions [22]. Thus, develop the required infrastructure and facilities in ports based on demands.	9, 11
	Shaping	Invest in the criteria of site and situation introduced by Marti [61] to increase the attractiveness of cruise ports.	9, 11, 15, 16
	Hedging	Exercise flexibility in managing cruise calls to match supply capacity to demand by port authorities and diversify cruise calls to different ports to increase itineraries’ success and profitability [15]. Increase coordination with other neighboring ports [9] to reduce over-tourism issues [13], and port congestion [26]. Port congestion can also be alleviated by effective tour guides, an increase in the attractive sightseeing, and the gastronomy of the places visited [44]. Integrate smaller ports into larger and well-known cruise port operations (i.e., marquee ports) to increase network efficiency, preparedness, and risk management [62].	3, 7, 8, 9, 11, 17
	Shaping	Improve schedule reliability of small ports to allow the diversity of itineraries [9].	9, 17
	Shaping	Examine cruise companies’ priorities for the selection of ports of call [41].	9, 17
	Shaping	Invest in shore excursions of ports and port aesthetics to further customer satisfaction and loyalty in harbor tourism [63].	8, 9, 11, 14, 15, 17
	Shaping	Focus on sustainable long-term contracts with cruise lines to satisfy their demand on port infrastructure, operation, and services and thus alleviate congestion in ports, and increase service quality and safety/security of passengers [26].	8, 9, 11, 14, 15, 17
	Shaping	Build capacity to operationalize medical facilities for quarantine and be ready to set up isolation centers as needed [64].	3, 9, 17
	Mitigating	Promote resilience building through investment in technology and digitalization, risk assessment and management, and preparedness.	3, 9, 11, 17
	Mitigating	Follow recommendations for ports’ staff protection presented by UNCTAD [54].	3, 8
Shaping	Improve port infrastructure and facilities [59], value-added services, and port governance [9].	8, 9, 17	

Table 2. *Cont.*

Cruise Sector Parties	Actions	Description	UN SDGs
Port cities	Shaping	Increase the quality of shore attractions to increase the attractiveness of port cities [65].	8, 9, 11, 14, 15, 17
	Mitigating	Cope with infections and infected people that should be disembarked and need to go onshore [18].	3, 17
	Mitigating	Limit/control population movement around ports and in cities [13].	3
	Shaping	Increase societal integration of ports and public services to increase passengers' satisfaction [9].	8, 9, 11, 14, 15, 17
	Mitigating	Follow recommendations presented by UNCTAD [54] for the protection of the surrounding community as well as cruise passengers.	3, 8, 11, 16, 17

Table 2 indicates that there are a variety of actions that enable the cruise industry to maintain performance under pandemic conditions, in the aftermath of a pandemic and in preparation for a future pandemic. As can be seen, each action can contribute to one or more UN SDGs. This table provides policymakers with an overview to gain a better understanding of the contributions of adaptive actions to the UN SDGs. It should be noted that some actions may not have a direct link to a UN SDG. On the other hand, taking actions in one area may affect actions taken by others (and thus their UN SDGs).

Although this paper provides general actions for sustainable cruising during and in the aftermath of the COVID pandemic, a detailed specification of the actions might be needed in response to specific needs due to COVID or another infectious disease on a particular cruise sector party. Furthermore, a deep understanding of the economic, environmental, and social implications of the cruise sector is required. This necessitates relevant stakeholders, including scientists and policymakers, to plan actions and act according to the drivers, pressures, and responses affecting impacts, while simultaneously enhancing the three dimensions of sustainability. As numerous stakeholders with different spatial and temporal influences and interests are involved [67], effective and continued stakeholder inclusion should be considered to satisfy their objectives [68].

The results of the literature review indicate that a more comprehensive list of actions has been developed by cruise liners and cruise ships to respond to the COVID pandemic, than by cruise ports and port cities. The reason could be because ports have different functions and the actions might have been developed for other purposes (e.g., container ships, cargo handling). This can also be the case for port cities and that required actions have already been developed, for instance, for the public and not specifically for cruise passengers.

Port cities should analyze their capacity, assess challenges and constraints, and provide essential facilities and services to first mitigate the impacts of the pandemic and then benefit from the resumption and growth of cruise tourism post the pandemic. Cruise ports are a fundamental connection between cruise ships and port cities. They have a significant role in sustainable cruising during and after the pandemic. Cruise ports need to become more engaged, as changes to a sustainable form of cruising are only possible when cruise liners and port cities become more aware of the central role of ports. Providing basic (super) infrastructure may not be the main attraction, and organization in terms of offering services is becoming more important for cruising during and after the pandemic. Managing cruise passengers (and increasing their loyalty) cannot happen without the support and efforts of cruise ports, many of whom fully understand the link between loyalty and cruise revisits, their efforts need to be supported and strengthened (UN SDG #8).

Cruise ports could apply several shaping actions to improve required infrastructure and mitigating actions to increase service quality. Spatial scales, ranging from small to large ports of call, as well as temporal scales, in short-, middle-, and long-term horizons may affect the planning of actions. Port authorities can relieve the congestion by servicing cruise

ships in a wider tourism area and using the potential of smaller ports or even neighboring ports. This increases the reliability of ports and society and thus strengthens customer loyalty [58]. Port authorities could optimize existing cruise port governance models to further increase preparedness and facilitate adaptation. Port infrastructure and facilities need to be adapted to the increasing size of cruise ships and the seasonality of the industry to satisfy stakeholders [69].

The other parties, including cruise liners, cruise ships, and port cities, are mainly required to apply mitigating actions for better servicing to the customers. Digitalization and information sharing are critical for cruising during the COVID pandemic and in its aftermath, they are key components of resilience building. Moreover, key stakeholders could work together to develop contingency plans (with ad-hoc solutions) in dealing with unexpected disruptions and ensure business continuity.

5. Conclusions

The COVID pandemic has confronted the cruise sector with infrastructural, service, and operational challenges. This is evident in the urgent need for new infrastructure and public services (e.g., in cruise ports and cruise cities) to ensure that health and safety protocols are in place. This is also evident in the demand for safer operations in which digitalization and rising awareness/education will increasingly play an important role. Adaptations are required to face the challenges and resume sustainable cruising in and post-pandemic era.

A system thinking approach was applied and a literature review was carried out to identify adaptive actions for sustainable cruising during and after the COVID pandemic. The literature review explored numerous academic peer-reviewed articles and policy and technical reports. The adaptive actions were a response to the challenges presented by the pandemic on infrastructure, operation, and services for the cruise sector, focusing on cruise liners, cruise ships, cruise ports, and port cities.

The actions were linked to the UN SDGs to increase the awareness of their sustainability contributions when moving forward. Sustainable cruising after the COVID pandemic necessitates particular considerations to UN SDGs #3, #4, and #17. This has managerial implications for policymakers and managers, particularly those who are active in sustainability measures and implementation.

However, it is important to be aware of various policy arenas between different cruise sector parties for reaching the UN SDGs. Scientific communities have a responsibility to provide information, data, and solutions (i.e., action) to the cruise sector and policymakers. The importance of educational efforts for stakeholders in different sectors should be embraced. Effective collaboration, cooperation, and coordination among stakeholders play a crucial role in sustainable cruising post the pandemic.

It should be noted that actions might be interconnected and action for one sector party may contribute to others, therefore different aggregation of the parties (cruise sector categories) can appear in different studies. The link between actions and the UN SDGs is subject to the authors' interpretation and judgement; others may have different interpretations and can enrich the discussion. The references regarding the impact of the COVID pandemic are mainly focused on cruise ships, which represent only one sector in the industry. Therefore, the predominant focus on one sector is a limitation of this study.

Ports play a crucial role in the resumption of cruise calls and advancing the UN SDGs. As ports are unique in terms of their social, environmental, and economic settings, it is recommended that they tailor their adaptive actions to respond to the pandemic based on circumstances.

The academic implication of this research is to show the contributions of the cruise industry (i.e., cruise liners, cruise ships, cruise ports, port cities) to all SDGs, which extends the previous literature that discussed the involvement of a cruise sector in one (or all) UN SDGs. It suggests comprehensive adaptive actions in response to the COVID pandemic for cruise sectors and then links the actions to the UN SDGs. This provides an overview of

effort/resource allocation strategies/involvement required for a sustainable cruise industry during and after the COVID pandemic. It pinpoints the UN SDGs that require more collective efforts from the industry. Furthermore, it can serve as a reference for each sector (i.e., cruise liners, cruise ships, cruise ports, port cities) in the industry to develop sustainable development strategies and seize opportunities for shared value creation.

Future research could focus on:

- Defining actions specifically for cruise ports (not a multifunction port), or other related sectors, for instance, tourist and shore excursion companies;
- Evaluating the impacts of the actions on the sustainability of cruise sectors during and after the pandemic;
- Investigating various recovery strategies for the cruise sectors;
- Developing innovative policies to increase the resilience of the cruise industry against disruptions.

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