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The Coevolutionary Process of Maritime Management of Shipping Industry in the Context of the COVID-19 Pandemic

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Abstract: This study investigates how international organizations, International Maritime Organization (IMO) member states, and associate members have embarked on maritime management (MM) measures to address dire situations in the context of the COVID-19 pandemic. It explores the evolution of MM practices from international organizations, IMO member states, and associate members to ensure the resilience and sustainability of the shipping industry. Corpus linguistics was employed as a computer-assisted method to assess a large number of naturally occurring texts. Circular letters from international organizations and member states listed on the IMO website from January 2020 to July 2021 were curated and built into three corpora. Through corpus linguistic analysis of circulars from three different crisis phases (Pre-/early-crisis, Crisis in progress, Post-COVID-19 crisis phase), we discovered an MM progression mechanism developed between stakeholders in conjunction with the post-crisis period. The study presented the "MM-as-process" vision to emphasize the time-varying dynamic nature of MM development during the disruption.

Keywords: crisis management; maritime management; circular letter; corpus linguistics; coevolution

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1. Introduction

The COVID-19 pandemic has significantly impacted the global shipping industry, causing a severe crisis [1–4]. United Nations Conference on Trade and Development (UNCTAD) has calculated that the amount of international seaborne trade fell by 4.1% in 2020 [5]. Over the pandemic period, shipping demonstrated its reliability and resilience as one of the most economical and efficient modes of transportation. The international supply chain did not suffer significant disruptions. However, seafarers struggled to work on board, and their health and safety were seriously threatened. It was estimated that about 400,000 seafarers were waiting to either be relieved or join their ships. Thanks to the cooperative efforts of the international community, such as international organizations, member countries, the data was reduced from 400,000 to 200,000 [6]. With so many seafarers as front-line workers awaiting rescue, the humanitarian crisis at sea continues to grow.

Although the COVID-19 pandemic continues to bring crisis and uncertainty to the shipping industry, IMO, member states, associate members, and relevant international organizations have been active in issuing circular letters providing maritime management measures to assist shipping stakeholders in coping with adversity. From January 2020 to July 2021, IMO issued 352 circular letters on pandemics covering a variety of matters to minimize the impact of pandemics on international shipping by providing comprehensive guidance and advice to member states and the shipping community shown in Figure 1. In January and February 2020, IMO issued three circular letters. Subsequently in March and April, 20 and 68 circular letters were sent by member states, respectively, showing a dramatic increase, which shows that IMO plays an important leadership role. In addition, the number of maritime proposals submitted by member states is shown in Table 1. In this regard, it is possible to explain to some extent the performance of member states to fulfill their obligations. It is unprecedented in the history of IMO to issue so many circular letters in less than two years dealing with the subject of the pandemic.

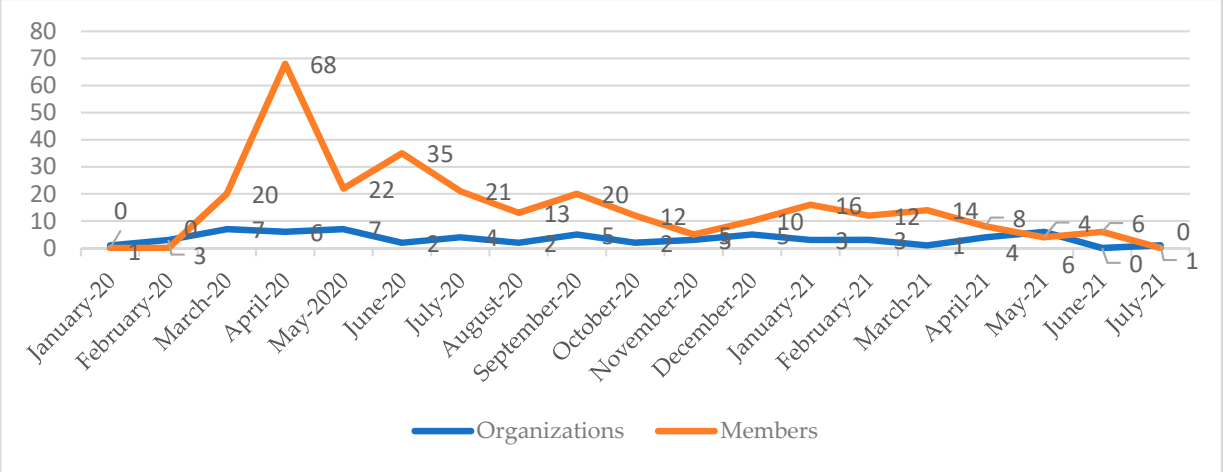

Figure 1. Time and quantity of circular letters from member states and international organizations.

Table 1. Number of maritime proposals from member states (more than 5).

Member States	No.	Member States	No.
The Republic of Italy	19	The Kingdom of Sweden	6
The Republic of Panama	17	The Republic of the Union of Myanmar	6
The People's Republic of China	10	The Republic of Turkey	6
Philippines	10	India	6
The French Republic	9	The Democratic Socialist	5
The Russian Federation	9	The Kingdom of Spain	5
Saint Vincent and the Grenadines	9	The Argentine Republic	5
The Islamic Republic of Iran	6	The Republic of Kiribati	5
The Republic of Azerbaijan	6	-	-

Recently there have been studies on cruise management [1–3], ship inspection [4], Corporate Social Responsibility (CSR) of hotels [7], and air transport emergency strategies [8,9]. However, few articles have examined maritime management in the shipping industry from the perspective of maritime proposals. Research on maritime management is extensive, and most of them conceptualize it as an event or a cause/consequence [10–13]. This line of research focuses on maritime accidents [14], Port State Control (PSC) inspections [4,15], and the marine environment [16]. This static vision of traditional maritime management is essential because it lays the core foundation for future research. However, as we delve further into the empirics raised in the current project study, maritime management is a dynamic and time-varying strategic response to crises.

IMO has issued 352 circulars in one year and a half, all of them on the subject of COVID-19, which was unprecedented in history. It is relatively common to study texts such as maritime accident investigation reports [17], CSR reports [18], and news releases [9], but maritime circulars have not been studied. It is, therefore, an innovation to use textual analysis to analyze maritime circulars. This research endeavors to tackle the aforementioned research gap by examining the evolution of maritime management during the explosion of the shipping industry and emphasizing the process perspective of maritime management. It seeks to answer how the shipping industry adapted its maritime management practices to assist stakeholders in addressing adversity during the different phases of the disaster. This study introduced theories of crisis management and organization resilience and adopted the research methodology of corpus linguistics [19] to evaluate a vast amount of textual data (i.e., circular letters) collected from the IMO website [19]. The research contributes not only in its ability to illustrate how the IMO was able to motivate efforts to minimize the impact and damage of the epidemic on the sustainability of the shipping industry but also in examining the circumstances that contributed to the crisis and how organizations were able to respond to different phases of the situation. More importantly, as we uncover the coherence between the pandemic's influence and the shipping industry's responses

to alleviate the difficulties faced by stakeholders, we construct new modeling that highlights the coevolution of maritime management by stakeholders. Maritime management theory has been continuously improved during the development of the shipping industry. Maritime management theory has been continuously improved during the development of the shipping industry. Based on the process view of the crisis, this study proposes a new research direction—maritime management-as-process [20].

The rest of the study is organized as follows. Firstly, theoretical background on crisis management, organization resilience, and maritime management and framing are presented. Secondly, the research methodology is determined based on the procedure and type of data collected. This paper applies a corpus linguistic approach to obtain text data from IMO's website. In order to study the evolution of maritime management, this paper divides the pandemic into three phases: Pre-/early-crisis, Crisis in progress, Post-COVID-19 crisis phase. Thirdly, findings are presented based on keywords for quantitative analysis and concordance for qualitative research, mainly around the evolution of maritime management measures at different stages of the process. Finally, conclusions are drawn based on theoretical and practical implications, contributing new insights to the literature.

2. Theoretical Framework

2.1. Crisis Management

The definition of crisis management is "a set of factors designed to combat crises and to lessen the actual damage inflicted by a crisis" [21]. There are two significant types of literature related to this field of study: crisis as an event and crisis as a process [20]. From the crisis-as-event perspective, one cannot thoroughly plan for a crisis event due to the inability to consider the probability of potential risks [22]. This event-centered research paradigm facilitates the analysis of the consequences of the crisis [20]. The crisis-as-process approach emphasizes the importance of pre-event, in-event, and post-event crisis management [20]. In this process approach, "a crisis is considered to be a long incubation process that manifests itself suddenly under the influence of a precipitating event" [23]. Based on the research theme, this study takes a view of the crisis as a process, analyzing the evolution of the crisis and the actions taken by IMO. On this view, crisis management is understood to be "managing attention to 'weak signals' of crises-in process, in-event organizing, and post-event actions to protect a system and (when necessary) bring it back into alignment" [20].

Two critical properties impact the view of how to manage a crisis. First, crises contain multiple phases. Recognizing how organizational systems are affected by adversity (and thus how organizations respond to adversity and gain resilience) facilitates coping with the complexity of managing crises within an organizational context [24]. Secondly, there are complex relationships among stakeholders that provide severe challenges in dealing with crises [25]. Organizations must constantly adapt and adjust their operational models and practices to achieve resilience utilizing a range of resource endowments to enhance their renewed ability to respond to crises [20].

2.2. Organization Resilience

In 1973, Holling in Canada first introduced the concept of resilience, which falls under the umbrella of ecology. His research concluded that ecosystems are resilient and adaptive [26]. The concept of resilience has spread from ecology into other fields, such as supply chain [27], maritime safety [28], Non-Governmental Organizations (NGO) sustainability [29], etc. Resilience has three main primary properties [30]: (1) The quantity of change that an organization can withstand without changing its structure and function in the face of external pressure. (2) The ability of an organization to maintain its state in the absence of external interference. (3) The degree to which the organization can learn and adapt in the presence of external disturbances.

As maritime transport is a complex system, the concept of resilience is firstly introduced to study maritime safety due to the limitations of safety regulations and risk

management to ensure the safety of shipping [28]. A study examined the contributing factors and performance outcomes of resilience in maritime companies from a relational perspective [31]. The outbreak has caused disruptions to the supply chain and has had a severe impact on the normal functioning of goods worldwide. In the context of the epidemic, resilience allows IMO to continue to provide core functionality by proactively determining a response strategy that reduces the impact of disruptions while returning to the original state [32].

2.3. Maritime Management

Maritime management involves employing and maneuvering human, financial, technical, and natural resources associated with the sea, maritime navigation, shipping, port development, and coastal protection [10]. Strategic maritime management is defined as the field of strategic maritime management that deals with the major intended and emergent initiatives taken by general managers on behalf of both owners and stakeholders, involving utilization of resources, to enhance the performance of maritime organizations in the global maritime environment [13]. Maritime traffic management is a process of information exchange and cooperation. It improves safety and sustainability by optimizing the maritime transport chain [11]. Strategic maritime management and sea traffic safety management contribute well to safeguard stakeholders in the shipping industry and optimizing the maritime logistics supply chain. The targets of maritime management include the crew, the ship, the cargo, the shipowner, the maritime authorities, and the relevant international organizations, who are a community of interest.

In this crisis, maritime management played an essential role for the shipping industry in terms of (i) the ability to manage crises and (ii) the ability of interventions to influence collective and individual performance and effectively enhance crisis response. The epidemic has affected the sustainability of the shipping industry and posed a challenge to maritime management. IMO provides the organizational security for maritime management and has a leading position in the shipping community. It is therefore important to derive strategies for the evolution of maritime management by studying maritime proposals.

This study integrated a theoretical framework through theoretical explanations of crisis management, organization resilience, and maritime management (see Figure 2). First, the shipping crisis triggered by the epidemic is characterized by suddenness and stage, so this paper draws on the process perspective of crisis management. Second, the global logistics supply chain was not significantly disrupted by the shipping crisis, reflecting the organization resilience of the shipping industry. Therefore, the theory of organization resilience is also applied to the project. Third, maritime management involved all aspects of the shipping industry and accompanied the entire process of crisis development. Maritime management can improve crisis management capabilities and enhance the level of organizational resilience. In conclusion, there was no necessary boundary between the three theories, but rather a mutually reinforcing relationship, and together they provided the theoretical support for the study of this crisis.

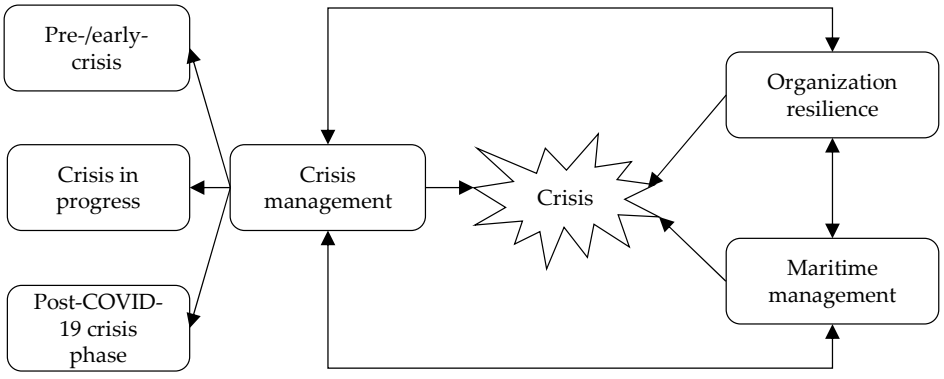

Figure 2. Integrated theoretical framework.

3. Methods

The data includes textual and digital data, and the research object of this paper is textual data. Therefore, this study employed a text analysis approach, which belongs to corpus linguistics [33]. Through a review of the literature, corpus linguistics has been widely applied in interdisciplinary research, such as hoteliers' organizational crisis communication [7], the coevolutionary process of restaurant CSR [34], and strategic crisis response of airline corporations [9]. The corpus has two significant characteristics, a collection of texts stored in electronic databases and naturally occurring texts [35]. Corpus linguistics is the extraction and study of these texts [19,35]. Compared to other research methods, it allows not only qualitative analysis but also quantitative analysis. By quantifying frequency, the analyst discovers the most meaningful words (or other elements) in the text, then studies in detail in their original context. Finally, the most prominent contextual themes are reflected through the form of frequency. Therefore, a platform for interactive communication between frequency lists and qualitative analysis is created.

Corpus linguistics can be used for multiple analyses, and based on the research in this paper, keyword and concordance analyses are the most effective. The comparative analysis of the two corpora is a crucial step in deriving statistically more frequent keywords than expected. One of the two corpora is served as a reference corpus. Next, keywords reveal the most distinctive thematic and stylistic choices in a given corpus and suggest to the analyst which words are most deserving of more in-depth contextual analysis [36]. In the study, the negative keywords indicate overuse in the reference corpus. On the contrary, the positive keywords indicate a relatively high frequency in the target corpus. Concordance analysis allows the researcher to understand the context in which the keywords are located. Concordance analysis also referred to as "keyword in context" concordance, is at the core of the neo-Firthian corpus approach.

Since IMO provides organizational safeguards for the shipping industry, the maritime circular letters related to the COVID-19 listed in the IMO were chosen for data collection. The circular letters were divided into three phrases, depending on the stage of development of the epidemic: (1) The first stage, the dawn of the crisis, January 2020 to March 2020, indicates the pre-/early-crisis. (2) The second stage, crisis in progress, April 2020 to April 2021. (3) The third stage, the post-epidemic era, May 2021 to July 2021. It is worth noting that IMO urged member states and authorities in May 2021 to prioritize seafarers' vaccinations. These circular letters were then built into three corpora: Stage 1 Corpus (January 2020 to February 2020, 4 circular letters, 3342 words), Stage 2 Corpus (March 2020 to April 2021, 331 circular letters, 715,785 words), Stage 3 Corpus (May 2021 to July 2021, 17 circular letters, 41,562 words). The specific descriptions of the three corpora are shown in Table 2. Since LancsBox has a powerful corpus processing function, this study utilized it to perform keyword analysis and concordance analysis [37]. Additionally, stop words, international organizations, and country names were removed from further analysis in order to focus on the lexical patterns and to reduce bias from the sampled data, respectively. In addition, stop words and other irrelevant symbols were removed from this study to focus on linguistic patterns and minimize bias in the sample data.

Table 2. The specific descriptions of the three corpora.

Phase	Files	Tokens	Types	Lemmas
Stage 1	4	3342	822	779
Stage 2	331	715,785	51,479	50,425
Stage 3	17	41,562	6433	6027

4. Findings

4.1. Keyword Analysis

Positive and negative keywords can be derived by comparing the Stage 1 Corpus and the Stage 2 Corpus, the Stage 2 Corpus and the Stage 3 Corpus. These keywords were derived based on the Log-Likelihood significance test, which can reveal the characteristics

and focus of the text at different stages. Since the three corpora were of various sizes, they were standardized using relative frequencies with a 99.99% confidence ($p < 0.001$). The two corpora were compared and analyzed to identify positive and negative keywords. Due to space concerns, some representative keywords were listed, as shown in Tables 3–6. The positive keywords and negative keywords characterized the overall tone of the corpora at different stages.

Table 3. Negative keywords for Stage 2 to Stage 1.

Type	Stage 2		Stage 1		Statistic
	Frequency1	Dispersion1	Frequency2	Dispersion2	
Infections	0.32	9.13	14.96	1.10	0.08
Healthcare	0.60	6.68	14.96	1.01	0.10
Handwashing	0.07	10.06	8.98	1.05	0.11
Incubation	0.28	8.16	8.98	1.18	0.13
WHO	14.53	1.56	104.73	0.55	0.15
Cough	1.63	5.30	14.96	1.01	0.17
Shipyards	0.27	5.22	5.98	1.05	0.18
Risks	1.90	3.32	14.96	0.63	0.18
Implemented	1.48	2.65	11.97	0.80	0.19
Cooperate	0.41	6.20	5.98	1.05	0.20
Enforcement	0.42	4.14	5.98	1.73	0.20
Fever	2.04	4.44	11.97	1.15	0.23
Convention	6.73	1.70	29.92	1.29	0.25
Endeavor	0.07	10.32	2.99	1.73	0.27
Domestic	0.95	4.85	5.98	1.02	0.28
Trade	3.49	2.97	14.96	1.41	0.28

Note: The negative keywords were arranged from small to large by the statistics.

Table 4. Positive keywords for Stage 2 to Stage 1.

Type	Stage 2		Stage 1		Statistic
	Frequency1	Dispersion1	Frequency2	Dispersion2	
Crew	42.28	1.84	0	0	43.28
Extension	17.14	1.25	0	0	18.14
Certificate	16.47	1.52	0	0	17.47
Pandemic	14.33	1.04	0	0	15.33
Panama	13.65	4.35	0	0	14.65
Members	13.03	1.14	0	0	14.03
Validity	12.36	1.41	0	0	13.36
Seafarer	11.96	1.68	0	0	12.96
Government	11.46	0.98	0	0	12.46
Authority	11.33	2.13	0	0	12.33
Administration	10.60	1.84	0	0	11.60
Surveys	7.84	2.04	0	0	8.84
Company	7.71	2.52	0	0	8.71
Certificates	30.95	1.18	2.99	1.73	8.00
Extended	6.83	1.51	0	0	7.83
Change	6.79	2.51	0	0	7.79

Note: The positive keywords were arranged from large to small by the statistics.

Stage 1. As shown in Table 3, a large number of crisis-related keywords (e.g., "infections", "healthcare", "handwashing", "incubation", "cough", "risks", "fever") and maritime management-related keywords (e.g., "implemented", "cooperate" "enforcement", "convention", "endeavor", "repair") appeared in Stage 1, indicating that maritime management has functioned. From the "cooperate" perspective, member states, shipping companies, port authorities, and other organizations should cooperate to ensure crew health and supply chain. The "implemented", "enforcement", and "convention" demonstrated the emphasis in the instruments issued by IMO on the impact that the implementation of

international maritime conventions would have on the shipping industry. These conventions and regulations included but were not limited to: (1) International Convention for Safety of Life at Sea, 1974 (SOLAS, 1974). (2) International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL, 1973). (3) International Convention for the Control and Management of Ships Ballast Water and Sediments, 2004 (BWS, 2004). (4) International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978 (STCW, 1978). (5) Maritime Labour Convention, 2006 (MLC, 2006). (6) Resolution A.1119(30), Procedures for port State control, 2017. Moreover, the risk-related keywords reflected the symptoms of infection with COVID-19 and the protective measures that need to be taken. Hence, IMO actively communicated and coordinated to prepare for the crisis in the pre-/early-crisis phase.

Table 5. Negative keywords for Stage 3 to Stage 2.

Type	Stage 3		Stage 2		Statistic
	Frequency1	Dispersion1	Frequency2	Dispersion2	
Panama	0.24	4.00	13.65	4.35	0.08
Inspection	0	0	4.39	2.52	0.19
Survey	0	0	4.23	2.60	0.19
Registry	0	0	2.58	3.62	0.28
Epidemic	0.24	4.00	3.31	4.23	0.29
Accommodation	0	0	2.42	5.07	0.29
Extensions	0.24	4.00	2.47	2.58	0.36
Airport	0.72	4.00	3.67	5.79	0.37
Endorsement	0.48	3.42	2.56	2.63	0.42
Isolated	0	0	1.36	4.53	0.42
Philippines	0.24	4.00	1.84	4.94	0.44
Exemption	0	0	1.22	6.12	0.45
Expire	0.96	2.04	3.34	2.01	0.45
Singapore	0.96	3.15	3.27	6.08	0.46
Certificates	13.96	1.63	30.95	1.18	0.47
Cough	0.24	4.00	1.63	5.30	0.47

Note: The negative keywords were arranged from small to large by the statistics.

Table 6. Positive keywords for Stage 3 to Stage 2. Note: Source: calculated by the authors.

Type	Stage 3		Stage 2		Statistic
	Frequency1	Dispersion1	Frequency2	Dispersion2	
Vaccination	28.39	1.87	0.53	13.62	19.20
Rights	25.98	4.00	0.46	6.22	18.47
Vaccine	17.32	3.98	0.15	8.74	15.89
Human	26.23	3.85	1.12	8.34	12.86
Cruise	28.39	3.90	1.58	7.52	11.40
Roadmap	4.57	2.75	0.07	10.39	5.21
Logistic	1.92	2.95	0.03	18.14	2.85
Immunization	1.68	4.00	0	0	2.68
Restart	1.68	4.00	0	0	2.68
Multi-disciplinary	1.68	3.20	0	0	2.68
ILO	6.50	3.67	1.84	4.78	2.64
e-Governance	1.68	4.00	0.04	18.14	2.58
Manufacture	1.68	4.00	0.04	13.29	2.58
e-Certificate	1.44	4.00	0	0	2.44
Guidance	28.39	1.69	11.11	1.93	2.43
Methodology	1.20	3.28	0	0	2.20

Note: The positive keywords were arranged from large to small by the statistics.

Stage 2. With the World Health Organization (WHO) declaring COVID-19 a global pandemic in March, the shipping crisis intensified and officially entered a crisis phase. Unlike Stage 1, Stage 2 was more inclined to the impact caused by the situation and the measures taken by the stakeholders. Table 4 list the keywords that highlight the lexical features of Stage 2. Most of these positive keywords were only overused in Stage 2,

which can show the textual characteristics of Stage 2. The certificate-related keywords (e.g., "extension", "certificate", "validity", "certificates", "extended") were particularly prominent, indicating the impact of the epidemic on certificates under the international maritime convention. Why was "Panama" overused in Stage 2 while the other member states did not appear? We may interpret it in the following two ways. On the one hand, Panama issued 17 circular letters, ranking second among member states. On the other hand, vessels flying the Panamanian flag were the most numerous [38], accounting for about 16% of the total number of ships globally, with a total of 7886 merchant ships of gross tonnage (GT) or more [5,38]. Table 5 lists the significantly overused keywords in Stage 2 relative to Stage 3. Table 5 also summarizes the incredibly overused keywords in Stage 2 comparable to Stage 3. When Tables 4 and 5 were analyzed together, the text features of Stage 2 can be synthesized. Keywords that appeared in both Tables 4 and 5 included "extension", "certificate", "Panama". This further explained that the pandemic caused the extension of the certificate, and Panama was a representative of the member states. In addition, the maritime management-related keywords (e.g., "authority", "administration", "surveys", "registry") indicated the measures taken by the stakeholders. In addition, the travel-related keywords (e.g., "change", "accommodation", "airport") were particularly noticeable, suggesting that the outbreak has severely influenced crew travel and change. Compared with Table 4, the keyword themes of Table 5 are more dispersed. It is more suitable that these keywords can be analyzed in-depth in the concordance analysis section.

Stage 3. With inventing the COVID-19 vaccine, IMO called on member states to prioritize vaccination of seafarers, indicating that Stage 3 entered the post-epidemic era. By the end of June, 60 member states and two associate member states were actively fulfilling their membership obligations by issuing declarations recognizing seafarers as key workers, as listed in Appendix A, Table A1, which facilitates their priority for vaccination and medical assistance. Table 6 indicated that "human" and "rights" appeared in both Stage 2 and Stage 3, and more often in Stage 3 than in Stage 2, suggesting that "human" and "rights" have received increasing attention over time. The overuse of "roadmap" in Stage 3 indicated that it functioned as a somewhat guidance for the outbreak. "Risks", "immunization", "restart", "e-Certificate", and "methodology" only occur in Stage 3, implying that they reinforce the textual features of Stage 3. Moreover, "e-Certificate" and "e-Governance" illustrated that electronic offices were more prevalent in Stage 3. International Labour Organization (ILO), the only tripartite United Nations (U.N.) agency that sets labor standards, develops policies, and devises programs promoting decent work for all women and men, appeared 132 times in Stage 2 and 27 times in Stage 3, sufficiently demonstrating that ILO contributed significantly to safeguarding the rights and welfare of the crew.

Based on the keyword analysis in the above three stages, this study divided the keywords in each stage into the following five themes: crisis, crew, ship, organization, and maritime management (see Table 7). Since Stage 1 was early in the crisis, the number of themes was relatively small. As the crisis intensified, four themes emerged in Stage 2 and five in Stage 3. In other words, the evolution of the theme reflected the progression of the epidemic's impact on the shipping industry. The keywords in Stage 1 revealed the signs that preceded the crisis (e.g., "risk", "cooperative", "fever"). The crisis intensified in Stage 2 and reached its peak with serious consequences (e.g., "extension", "validity", "change"). Stage 3 entered the post-epidemic era, where vaccines were invented, cruise ships were ready to restart, e-Governance was facilitated, and the human rights crisis remained a concern (e.g., "vaccine", "restart", "e-Governance", "rights"). The evolution of keywords and themes hence reflected the progression of the epidemic's impact on the shipping industry. The following section of the concordance analysis provided an in-depth analysis based on the themes and keywords of the three stages.

Table 7. Major themes.

Corpora	Themes	Keywords Used
Stage 1	Crisis	Infections, healthcare, handwashing, incubation, cough, risks, fever
	Organization	WHO
	Maritime management	Shipyards, implemented, cooperate, enforcement, convention, endeavor, domestic, trade
Stage 2	Crisis	Pandemic, epidemic, cough, isolated
	Crew	Crew, seafarer
	Organization	Panama, members, government, authority, company, Philippines, Singapore
	Maritime management	Certificate, validity, administration, surveys, certificates, extended, inspection, survey, registry, accommodation, extensions, airport, endorsement, exemption, expire, certificates
Stage 3	Crisis	vaccination, vaccine, roadmap, immunization
	Crew	Rights, human,
	Ship	Cruise, restart
	Organization	ILO
	Maritime Management	Logistic, e-Certificate, methodology, e-Governance

The shipping industry is at a pivotal moment of transformation and upgrading. On the one hand, it faces a shift from supply chain design and globalization models to changes in consumption and spending habits. On the other hand, more attention needs to be paid to building risk assessment and resilience [5]. However, what are the specific aspects of resilience through the circular letters? Next, resilience can be investigated through KWIC (keyword-in-context) (see Table 8). To summarize, the impact of resilience on shipping is primarily manifested in the following three areas: (1) the global economy, (2) the supply chains, and (3) the essential maritime workers.

Table 8. The keyword resilience in circular letters.

Left	Node	Right
international maritime transport to the	resilience	of the global economy at
supply chains to ensure the	resilience	of our national economies
has demonstrated its reliability and	resilience	as one of the most economic
as to shore up the	resilience	and sustainability of supply chains
may exacerbate the health and	resilience	challenges these essential maritime workers
the Shipping Tripartite Alliance	resilience	(STAR) Fund Taskforce to support

4.2. Concordance Analysis

The keywords and themes of the three stages were identified by quantitative keyword analysis. Next, a better interpretation of keywords and themes at different stages was performed based on qualitative consistency analysis. Due to space limitation, the keyword-in-context exemplary statements for the themes were shown in Appendix B, Table A2.

Stage 1. Pre-/early-crisis. IMO issued four circular letters with the subjects of Novel Coronavirus (2019-nCoV), COVID-19—Implementation and enforcement of relevant IMO instruments, as well as Joint Statement IMO-WHO on the Response to the COVID-19 Outbreak. IMO and WHO have made statements on the characterization of COVID-19 (i.e., "PHEIC"), symptoms of infection (e.g., "fever", "cough"), and response measures (e.g., "cooperate") in terms of crisis, crew, and maritime management. IMO has made a definitive determination that COVID-19 was a severe public health challenge that required close cooperation among all member states. What is more, WHO did not recommend any travel or trade restriction, ensuring that the global logistics supply chain was not interrupted. Based on the above analysis, these four circular letters provide direction to international organizations and member states to ensure the sustainable development of the shipping industry.

Stage 2. Crisis in progress. The crisis in the shipping industry continued to worsen as COVID-19 spread globally and culminated in Stage 2. These proposals were mainly focused on crisis, crew, ship, organization, and maritime management. Firstly, member

states actively responded to IMO's call to submit maritime proposals, taking into account their circumstances, for example, Panama, the Philippines, Singapore, China, New Zealand, etc. Secondly, some international organizations also played an important role in combatting the pandemic. IMO, WHO, and ILO, and other organizations, issued individual or joint statements on topics covering crew certification, ship certification, healthcare, crew travel, ship navigation, port management, and more. In addition, ICS published two versions of an outbreak prevention and control guide for ship operators. Thirdly, with port lockdown and travel restriction, a large number of seafarers continued to work beyond their contract period, resulting in a severe crew change crisis. On the one hand, the validity of seafarer certificates extended three months due to force majeure provided by MLC 2006. On the other hand, hundreds of thousands of seafarers struggled to work onboard beyond employment agreements and could not be repatriated. There are just as many seafarers who cannot get on board to work and make money to support their families. It has been causing a humanitarian crisis. Based on the above difficulties, IMO also established Seafarer Crisis Action Team (SCAT) to combat the humanitarian crisis caused by crew change. In addition, certain charterers added the "no change of crew" clause in charterparties for their benefit, which seriously undermines the crew's interests and navigation safety. In response, IMO issued statements strongly condemning such provisions and calling on shipowners and operators to reject such clauses.

Stage 3. Post-COVID-19 crisis phase. The "human rights crisis" and "crew change crisis" have attracted a great deal of attention from IMO. A tool used to support human rights due diligence was a positive response to the ongoing crisis. The tool launched by ILO, IMO, UN Global Compact (UNGC), and UN Human Rights (UNHR) includes the following three parts: (1) Measures that need to be taken by cargo owners and charterers with shipping. (2) Additional actions to be taken by shipping suppliers of cargoes. (3) Additional actions specifically for charterers. As we all know, cruise ships have been hit hard by this epidemic, and restarting cruise ships will contribute significantly to the recovery of the cruise economy. To facilitate the recovery of the cruise industry, the European Maritime Safety Agency (EMSA) and the European Centre for Disease Prevention and Control (ECDC) have issued a joint statement guiding the gradual recovery of the cruise industry in the EU, in particular specific operational instructions. ICS launched the Roadmap for Vaccination of International Seafarers, that set out procedures for a program that can be implemented by all stakeholders concerned to facilitate safe ship crew vaccination. When planning the setting up of a vaccination center, it must be ensured that logistic needs can be supported (for seafarers' access and vaccine distribution).

As shown in Appendix B, Table A2, international organizations and member states issued statements regarding epidemic prevention and control, crew and ship certificates, crew change, etc. Through keyword-in-context, we can understand the context in which keywords were located. IMO played a leading role and issued maritime circulars in all three stages. It is worth noting that Singapore released the second edition of the crew shift guide in June. The Philippines made a statement on the extension of SIB and SIRB. China has issued version 5.0 of the Guidelines for the Prevention and Control of the Crew's Epidemic. From another perspective, member states were actively responding to the call of IMO.

Through the analysis of the three stages, the following three patterns can be drawn. First, in terms of crisis, Stage 1 described the symptoms caused by COVID-19. In Stage 2, COVID-19 was identified as a global pandemic and gave comprehensive guidance on isolation and symptoms. In Stage 3, the vaccine was developed, and the crew could vaccinate according to the roadmap. The above characteristics of the crisis process can be explained by using the phased theory of crisis for reference. Second, IMO, WHO and ILO provided an organizational guarantee in dealing with the situation. Member states actively responded to the call of international organizations. They took measures in port state control, crew travel, certificate extension, vaccination, and crew change to ensure navigation safety, cargo operation, and crew rights and interests. Third, in maritime management, the first phase of maritime management focused on stakeholder

cooperation and convention implementation, evolved into the second phase of certificate management, ship inspection, and crew travel, and then evolved into the third phase of electronic certificate and electronic government management. This indicated that electronic means contributed to the implementation of maritime management during the crisis phase of the epidemic.

5. Discussion

Based on the above analysis, this paper presented an integrated framework that describes the impact of the three developmental stages of the crisis caused by COVID-19 on the shipping industry and the coevolution of maritime management (see Figure 3). As the crisis evolved, the focus of shipping industry stakeholders' concerns and maritime management measures also changed. In Stage 1, the shipping industry suffered from a weakened organization due to the epidemic, triggering the issuance of four circular letters from IMO, which could impact crew health, ship maintenance, and cargo flow. In response to the COVID-19 outbreak, IMO implemented maritime management measures in response to the emergency and called for increased international cooperation. In Stage 2, the crisis accelerated as the outbreak worsened, and the focus of stakeholder attention shifted from COVID-19 to the crew. As a result of port lockdown and travel restrictions, the crew change crisis emerged and IMO called on member states to facilitate crew change, as required by maritime conventions. During the period, IMO designated seafarers as key workers, which promoted cooperation among member states and relieved the crew change crisis. In Stage 3, the shipping community entered the post-epidemic era as vaccination was developed. The crew change crisis caused a human rights crisis when the crew continued to work onboard beyond their contract period, and other crew who were resting at home could not work onboard. The roadmap has provided route guidance to facilitate safe ship crew vaccination, which shipping companies, maritime administrations, and national health authorities used in liaison with other authorities. Crew immunizations not only alleviate the human rights crisis but also facilitate the functioning of logistics.

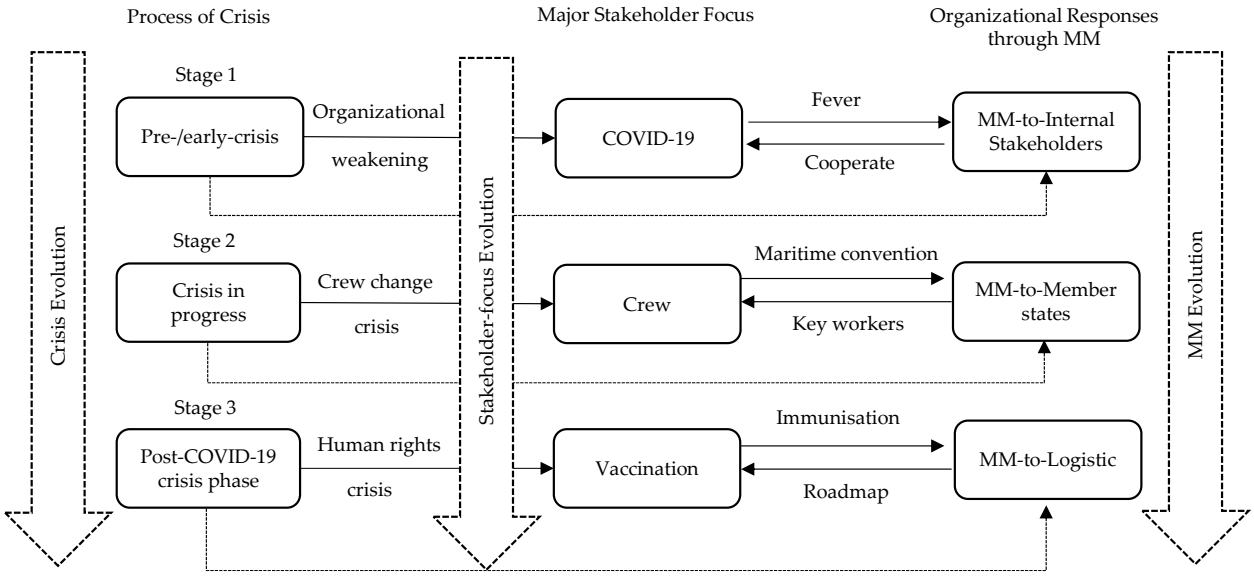

Figure 3. Evolution of Organizational Crisis Response via maritime management (MM).

5.1. Theoretical Implications

The critical contributions of the study to the literature include the following three areas, including crisis management, organization resilience, and maritime management. For crisis management, this paper employed a process perspective and divided the shipping crisis caused by the epidemic into three phases. In particular, we investigated the evolution of the crisis, taking the maritime circulars as a data source. International organizations

and member states took maritime management measures in an orderly manner according to the stage of development of the crisis and tried to meet the needs of stakeholders. As shown in Figure 3, as the crisis developed, the shipping industry experienced organizational weakness, then a crew change crisis, and finally evolved into a human rights crisis. The crisis-as-process perspective adopted in this study can explain the number and content of maritime proposals. This laid the theoretical foundation for future studies of shipping crises.

As for organization resilience, the global supply chain was not disrupted by the outbreak, and the shipping industry showed some organizational resilience. Although the epidemic has caused adversity in the shipping industry, the fact that cargo was still moving between the world's ports, that crews are still struggling to change shifts, and that the shipping economy was still slowly recovering, were concrete signs of resilience. The circular letters issued effectively reassured stakeholders in the shipping community and provided policy guidance for the organizational resilience of the shipping industry. In addition, this paper also provided a new research path for the study of organizational resilience through the KWIC analysis of resilience.

For maritime management, IMO takes maritime management measures in the form of maritime circulars, and the maritime management target was changing from the first stage of maritime management corresponding to domestic, to the second stage of maritime management corresponding to member states, to the third stage of maritime management corresponding to logistic. In particular, this study examined maritime management from a process perspective rather than a static one. The focus of different stakeholders' concerns and the impacts caused to varying stages of the crisis evolution process can be effectively analyzed.

In summary, research advances in crisis management, organization resilience, and maritime management can better understand crisis response as a complex and multilateral system. As illustrated in Figure 3, three kinds of evolution co-occurred: the evolution of the crisis, stakeholder concerns, and maritime management objectives. This study primarily emphasized the view that the severe crisis of the epidemic, while adversely affecting crew, member states, and logistics, maritime management was developed as an effective means to help build resilience among stakeholders. Therefore, it also pointed to new directions for subsequent academic research and industry practice on how crisis and maritime management can jointly influence stakeholders and build resilience back on themselves.

5.2. Managerial Implications

The keyword "certificates" was rather impressive. According to the requirements of STCW, MLC, ISPS, and other conventions, there are more types of certificates for crew and ships. The failure of the crew change promptly resulted in expired certificates that threatened crew health and ship safety, which were some of the cascading reactions. Improving maritime management measures to provide lessons for future responses to such crises deserves to be studied next.

The keyword "rights" appeared in both phase 2 and phase 3 and most frequently in phase 3. The absence of regular crew change has caused a severe humanitarian crisis. Although IMO has established SCAT, it can only solve the difficulties of a small group of people, and there are still many more crew members working onboard or staying at home waiting to join their ships. The governments and shipping companies of member countries can provide more assistance to the crew. For example, the government department that manages the crew makes policies to protect crew change and can even offer material and spiritual aid to the crew's family. Shipping companies can consider lifting crew members' wages and strengthening training for crew members on epidemic prevention and control.

An analysis of resilience through KWIC (keyword-in-context) reveals implications for the global economy, supply chain, and maritime workers. Of course, this paper just qualitatively analyzed resilience. Next, a quantitative study of resilience can be conducted to facilitate the economic development of the shipping industry.

Global maritime governance requires the attention and support of every shipping stakeholder. IMO and member states can take this crisis as an opportunity for global governance to explore more effective policies and techniques.

5.3. Limitations and Future Research Directions

Although this study took a longitudinal approach, collecting textual data on maritime circulars from the IMO website, it has to be acknowledged as having limitations. Firstly, in this paper, only maritime circular text data were selected for the study, and IMO website news and shipping company news reports were not considered. Maritime management is comprehensive, and we encourage the acquisition of more data, such as pictures, videos, and text reports, for multimodal research to better explore the evolution of maritime management in a crisis. Secondly, their performance can be assessed in the future based on proposals submitted by international organizations and member countries. This will promote the active implementation of obligations of international organizations and member states and improve IMO's management capacity. Finally, each country has some differences in the number of shipping companies, maritime governance capacity, and regional culture, and some differentiation studies can be conducted in the future.

6. Conclusions

For a better study of the evolutionary process of maritime management, this paper introduced three theories of crisis management, organizational resilience, and maritime management. It integrated them into a theoretical framework, which laid the theoretical foundation for analyzing the results. IMO is an international non-governmental organization that aims to protect the marine environment, safeguard the safety of navigation, and protect the interests of seafarers. During this crisis, crew members have made a massive contribution to the sustainability of the shipping industry as front-line workers, and IMO has recognized them as key workers. Maritime circulars are a critical way for international organizations and member states to release information, with 352 IMO circulars issued cumulatively from January 2020 to July 2021. LancsBox is semi-automated corpus processing software that can analyze unstructured text data. In this paper, maritime circulars were divided into three segments (Stage 1, Stage 2, Stage 3) to study. The keywords of each stage reflected the impact of the epidemic on the shipping industry. In other words, the keywords in each stage can reflect the evolutionary process of maritime management. Based on the above theoretical and analysis results, we presented an innovative "Evolution of Organization Crisis Response via Maritime Management", shown in Figure 3. The stakeholders in the shipping industry have responded positively to this crisis to keep the supply chain from significant disruptions. In addition, we can take this opportunity to improve the revision of maritime conventions. For example, MLC can further increase the provisions to protect the health of the crew. Predictably, the epidemic will not end in the short term, and it will continue to affect the shipping industry. Finally, this paper further improves the theoretical connotation of maritime management and provides a new research idea for future global maritime governance.

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Appendix A

Table A1. List of member states and associate members that have designated seafarers as key workers.

Europe	Asia	Americas	Africa	Middle East	Oceania
Azerbaijan Belgium Croatia Cyprus Denmark Finland France Georgia Germany Greece Ireland Italy Moldova Montenegro Netherlands Norway Poland Portugal Romania Russian Federation Slovenia Spain Sweden Turkey United Kingdom	Bangladesh India Indonesia Japan Myanmar Philippines Republic of Korea Singapore Thailand	Bahamas Barbados Brazil Canada Chile Dominica Jamaica Panama United States Venezuela (Bolivarian Republic of)	Egypt Gabon Gambia Ghana Kenya Liberia Nigeria South Africa	Iran (Islamic Republic of) Lebanon Saudi Arabia United Arab Emirates Yemen	Kiribati Marshall Islands New Zealand
Associate Members					
Faroes	Hong Kong (China)				

Appendix B

Table A2. Keyword-in-context: exemplary statements for the themes.

Corpora	Themes	Concordance Lines
Stage 1	Crisis	1. Avoid close contact with people suffering from acute respiratory infections such as with fever, cough, and difficulty breathing. (IMO) 2. In case of symptoms suggestive of acute respiratory illness either during or after travel, travelers are encouraged to seek medical attention and share their travel history with their healthcare provider. (IMO)(WHO) 3. Perform frequent handwashing, especially after direct contact with ill people or their environment. (IMO) 4. Infection from humans to humans may occur during the incubation period (before persons show signs of sickness). (IMO) 5. The purpose of this circular is to provide information and guidance, based on recommendations developed by the World Health Organization (WHO), on the precautions to be taken to minimize risks to seafarers, passengers, and others on board ships from novel coronavirus (2019-nCoV). (IMO)(WHO)
	Organization	1. With the information currently available on novel coronavirus, WHO advises that measures to limit the risk of exportation or importation of the disease should be implemented, without unnecessary restrictions on international traffic. (IMO)

Table A2. *Cont.*

Corpora	Themes	Concordance Lines
	Maritime management	1. In particular, flag state authorities, port state authorities and control regimes, companies and ship masters should cooperate, in the current context of the outbreak, to ensure that where appropriate, passengers can be embarked and disembarked, cargo operations can occur, ships can enter and depart shipyards for repair and survey, stores and supplies can be loaded, and crews can be exchanged. (IMO) 2. With the information currently available on novel coronavirus, WHO advises that measures to limit the risk of exportation or importation of the disease should be implemented, without unnecessary restrictions on international traffic. (IMO) 3. COVID-19 is a severe public health challenge that requires understanding and close cooperation among all Member States to overcome challenges related to the implementation and enforcement of the relevant IMO instruments. (IMO) 4. The Convention also requires port States to ensure that seafarers on board ships in their territory who are in need of immediate medical care are given access to medical facilities on shore. (IMO) 5. Further, IMO's Convention on the Facilitation of Maritime Traffic (commonly known as the "FAL Convention") states that non-Parties to the IHR shall endeavor to apply the IHR to international shipping. (IMO) 6. The current outbreak originated in Wuhan City, which is a major domestic and international transport hub. (IMO) 7. Following the advice of the Emergency Committee, the WHO Director General did not recommend any travel or trade restriction. (IMO)(WHO)
Stage 2	Crisis	1. On 11 March 2020, the Director-General of the WHO characterized the situation of the COVID-19 outbreak as a pandemic. (IMO)(WHO)(ILO) 2. In countries and at ports where epidemic has been notified, preventive and control measures should be taken in accordance with the local epidemic prevention and control requirements. (China) 3. If the test result is positive, the person must be isolated immediately, and the employer or client must notify the municipality. (Italy)
	Crew	1. Resolving the crew change crisis requires the best efforts of all stakeholders. The elimination of the use of "no crew change" clauses is just one of those efforts. (IMO) 2. Resolution MSC.473 (ES.2). Recommended action to facilitate ship crew change, access to medical care, and seafarer travel during the COVID-19 pandemic, adopted by the MSC on 21 September 2020. (IMO)
	Organization	1. Certificates of proficiency issued by an authorized Maritime Training Center of Panama in accordance with the regulation V and VI of the STCW amended (except those issued under regulation I/2) will be considered valid for a period of three months from its expiry date. (Panama) 2. By the date of this circular letter, the Secretary-General has received 58 notifications from Member States and two from Associate Members that they have designated seafarers as key workers, as listed in the annex. (IMO) 3. More support from the government and digitalization of processes in the supply chain, particularly administrative ones. (IPCSA) 4. For that reason, the Maritime Industry Authority realized the need for a longer extension of validity of the Seafarers Record Book (SRB) or Seafarers Identification and Record Book (SIRB) of Filipino seafarers who could not disembark their vessels and be safely repatriated due to travel restrictions imposed by several countries. (Philippines) 5. In the event that the application for crew change in Singapore is not approved, the company should plan for the crew change to be conducted at other ports that allow crew change. (Singapore)

Table A2. *Cont.*

Corpora	Themes	Concordance Lines
	Maritime management	1. Most IMO instruments contain requirements regarding the extension of the period of validity of a certificate, including SOLAS and MARPOL and associated codes mandatory under these Conventions, as well as the Load Line, BWM, 1 STCW and STCW-F Conventions. (IMO) 2. In a number of instances, e.g., conducting audits, surveys, inspections, and training remote possibilities exist which may eliminate the need to go onboard or reduce the numbers of personnel needing to attend. 3. The good practices carried out by Panama, who has faced a great challenge with the international maritime community as the world's largest ship registry, always paying due attention to the international standards that govern international maritime labor matters, such as the Maritime Labour Convention, 2006, as amended, should be shared and mimicked by other States, and that is what we are asking at this moment. (Panama) 4. Port and coastal States are also encouraged to take a pragmatic and practical approach in relation to these certificate and endorsement extensions, and their acceptance in the exercise of their respective responsibilities. (IMO) 5. While in the current situation renewals of medical certificates may not be possible, exemption from national restriction of movements physicians responsible for medical examination of seafarers should be considered. (IMO)(WHO)(ILO) 6. The effects of this outbreak are having a repercussion with the seafarers whose Certificate/s have expired or will expire soon, where the companies are facing problems because their planned disembarkation cannot be safely completed in ports affected by the outbreak of the Novel Coronavirus. (Panama)
Stage 3	Crisis	1. The designation of seafarers as "key workers" will facilitate their access to the vaccination, since most States are prioritizing essential workers in their national COVID-19 vaccination programmes, in accordance with the WHO SAGE Roadmap. (IMO) 2. The immunization process usually follows three steps: 1. Vaccine preparation; 2. Vaccine administration; and 3. Post-immunization waiting period. (ICS)
	Crew	1. Maritime human rights risks and the COVID-19 crew change crisis: a tool to support human rights due diligence. (IMO)
	Ship	1. The objective of the Guidance is to facilitate a safe restart of operations of cruise ships in the European Union by recommending minimum measures expected to be implemented by all those concerned, while maintaining general safety and security standards. (EMSA)(ECDC)
	Organization	1. Governments have the duty to protect human rights of seafarers and business has a distinct responsibility to respect their rights, UN Global Compact, in cooperation with the International Labour Organization (ILO), International Maritime Organization (IMO) and UN Human Rights, have launched a tool to support maritime human rights due diligence, as set out in the annex. (UNGC)(UNHR)(ILO)(IMO)
	Maritime management	1. Ensuring logistic needs can be supported (for seafarers' access and for vaccine distribution). (ICS) 2. MTI (Maritime Training Institutes) generates an e-Certificate as per existing procedure after appending the digital signatures of the course in charge and the principal. (India) 3. Go to E-Governance tab and click on e-governance. (India)

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