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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**A CASE STUDY ON THE IMPACTS OF COVID-19 ON SHIPPING
AND BIOSECURITY MEASURES IMPLEMENTED IN PORTS TO
MANAGE THE RISK OF THE DISEASE FROM SHIPS**

CLEOPATRA LATIFFAH CUEVAS
Belize

A dissertation submitted to the World Maritime University in partial
fulfilment of the requirements for the reward of the degree of

MASTER OF SCIENCE
in
MARITIME AFFAIRS

**(MARITIME SAFETY AND ENVIRONMENTAL
ADMINISTRATION)**

2020

Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

(Signature):

(Date):

Supervised by: Dr. Raphael Baumler

Supervisor's affiliation.....

Acknowledgements

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ABSTRACT

The outbreak of the Novel Coronavirus disease is the latest and ongoing pandemic at the time of writing. It has brought significant challenges, undermining national economies, public health, and safety, as well as international travel and trade.

This research was firstly aimed to investigate the coronavirus “shock on everything” (Olser, 2020a). This was done to determine if all segments of shipping have indeed been impacted by the current crisis through a mapping exercise. The exercise was conducted with data collected through a document review that was then collated on a global network map.

The map highlighted the interconnected and interdependent nature of the components in shipping; the magnitude of the impact COVID-19 has had on all components; and the ports as the site for measures implemented to stop the spread from ship.

As a result, the second aim of this research was to examine biosecurity measures implemented in ports to prevent the spread of the disease. To see how the existing regulations, i.e. IHR (2005), and the authoritative documents developed specifically for COVID-19 have been implemented by governments. The data on measures implemented in ports was gathered through a structured survey.

From the survey responses, key measures were highlighted for each site, as well as those considered “good practices”. Further, it was noted that the measures implemented in ports varied from one country to next. This variation in approaches taken may be attributed to the broad scope of the IHR (2005) and the countries being different (i.e resources, capacity, interpretation of regulations, how they perceive the threat etc).

A uniform framework would be needed to provide a clear direction to governments on measures that should be implemented without hindering seaborne trade. The Biosecurity Strategical Approach is the recommended framework for this purpose.

KEYWORDS: Coronavirus, Shipping, Shock, Biosecurity, Examine, Port, Measures

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LIST OF ABBREVIATIONS

AFS	International Convention on the Control of Harmful Anti-fouling Systems on Ships
BWMC	Ballast Water Management Convention
COVID-19	Coronavirus
EU	European Union
HAOP	Harmful Aquatic Organisms and Pathogens
ICS	International Chamber of Shipping
IHR (2005)	International Health Regulations
ILO	International Labour Organization
IMO	International Maritime Organization
ITF	International Transport Workers Federation
MARPOL	International Convention for the Prevention of Pollution from Ships
MSEA	Maritime Safety and Environmental Administration
NGO	Non-governmental Organization
OECD	Organisation for Economic Co-operation and Development
PHEIC	Public Health Emergencies of International Concern
PM	Port Management
POE	Point of Entry
RORO	Roll-on/Roll-off ships
PSC	Port State Control
SSC	Ship Sanitary Certificate
SOLAS	International Convention for the Safety of Life at Sea
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development

WHO	World Health Organization
WMU	World Maritime University
WTO	World Trade Organization

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Background of the Study

Naturally, species within an ecosystem have limited movement and long-distance interaction (Bellard et al., 2016). However, mankind developed tools for transporting people and cargo which overcame natural limitations and allowed new types of biological interaction. Additionally, transportation system such as ships became indispensable to modern societies.

Indeed, the combination of industrialization, technology, and trade massified the transport of goods and people on long distances. Consequently, as the world economy globalized negative externalities including impacts on biodiversity manifested (OECD, 2010) (Kumar, Yadav, & Rao, 2019).

The movement of cargo, plants, animals and people has increased the possibility of transferring biological matter beyond natural borders (Behringer et al., 2020). Potentially resulting in unexpected meetings of biodiversity, placing additional pressures on ecosystems and disrupting natural processes (Sardain et al., 2019).

Ships were long the only mode of transport that connected continents (Meyerson & Mooney, 2007). As time progressed, air transport became the primary mode of transport for passengers and high value cargo (Kimball, 2016). Nevertheless, shipping still dominates transport of cargo and raw material. Shipping accounts for 90% of world trade by volume and 70% by value (UNCTAD, 2018). However, some people are still carried

by ships such as crew members and passengers on cruise ships or ferries (Mouchtouri et al., 2010).

In short, as the growth in trade and transport increased so did the risk of contamination and transfer of biological matters such as pathogens (Ruiz, Carlton, Grosholz, & Hines, 1997).

Biodiversity Transported by Ships

Ships are considered a vector for the international spread of harmful organisms and pathogens. People on board ships are carrying their own pathogens which may spread to another location (Mouchtouri et al., 2010).

The ship as a vehicle may unintentionally or intentionally transfer harmful aquatic organisms and pathogens (HAOP) (Article 1 of BWMC), through ballast water, biofouling, ship design itself, cargo and waste (Mouchtouri et al., 2010). The cargo of the ship maybe contaminated by unwanted species such as fire ants (Lyu & Lee, 2017).

Protection of Human Health from Shipping

Biosecurity measures such as travel restrictions and quarantine practices have been in place to manage the threat of infectious diseases such as the plague from the 14th century (Mouchtouri et al., 2010). In a recent study by the World Health Organization (WHO), it confirmed the prevalence of shipping in transmission of diseases. The organization estimated that 100 disease outbreaks relate to ships from 1970 to 2003 (Rooney et al., 2004).

Recently, the international community adopted the WHO International Health Regulation (IHR 2005) to protect human health and threat of infectious disease at point of entries (Wamala et al., 2010).

COVID-19 in Shipping

The most recent emerging infectious disease, the novel Coronavirus (COVID-19), has led countries to activate an array of biosecurity practices to prevent the introduction and spread of the disease, as well as to demonstrate that they are safe to other countries.

The current crisis has had serious impact on the movement of people and cargo. The shipping industry is particularly affected and is targeted as a potential vehicle for transmission.

The importance of securing international shipping and protecting the public from health threats has highlighted the need to adopt an effective system to manage the transfer of pathogens without hindering global transportation and trade.

1.1 Significance of the Problem

The outbreak of the Coronavirus disease is revealing that there is still circulation of infectious disease at a global scale.

Shipping has played a significant role in the current spread of the Coronavirus (Ito et al., 2020). Cruise ships, with large number of passengers and port of calls, are a hot spot for the disease and its spread (Ito et al., 2020; Pham & Luengo-Oroz, 2020), as evident by the outbreak on the *Diamond Princess* cruise ship.

Due to rapid circulation of the disease, governments had reacted by nearly a complete stop of aviation, closure of land borders and a shutdown of the country's social and economic activities. Only allowing essential work, such as hospitals and ports, to continue.

Further, stringent quarantine and inspection measures are utilized to prevent the introduction and spread of the disease from ships. The measures taken, as reported to International Maritime Organization (IMO) by member states, varies from one nation to the next affecting maritime traffic and trade (IMO, 2020).

Intergovernmental organizations such as WHO, IMO, ILO, WTO, as well as International NGO's such as ITF and ICS¹ have made statements emphasizing that during public health emergencies it is counterproductive to restrict the movement of persons and goods, especially resources needed for intervention.

In a report by the OECD (2020), "the lockdown measures brought in by most governments have succeeded in slowing the spread of the virus and in reducing the death toll but they have also frozen business activity in many sectors". All these reactions have created a major disruption of global economy and "most countries are expected to face recessions in 2020" (World Bank, 2020, page 1).

Notably, an article on Lloyds list, has emphasized that "Coronavirus will surely be seen as the everything shock of 2020" (Olser, 2020). Therefore, it is necessary to assess the situation of COVID-19 in shipping and verify that it is a shock on all segments of the sector. It is also a good opportunity to see what biosecurity measures have been deployed by countries at ports.

¹ See abbreviations list.

1.2 Aims and Objectives

The overall intent of this research is to study the relationship between emerging infectious diseases, shipping, and biosecurity. Therefore, this research is aimed to achieve the following objectives:

- To investigate and map the impact of COVID-19 on shipping.
- To examine the measure deployed in ports to protect against the threat of COVID-19.
- To recognize good practices to improve ports capacity to manage biosecurity threats.

This will be accomplished by conducting two independent research. Firstly, a mapping exercise to investigate and map the impact of COVID-19 on shipping. Secondly, the use of structured survey to examine the measures deployed in ports to protect against the threat of COVID-19.

1.3 Research Questions

To meet the research objectives mentioned in **section 1.2**, the following research questions serve as a guide:

- How to map the impacts of COVID-19 on shipping? How this map could present/describe the shipping system? ²
- What are the biosecurity measures implemented in ports to protect against the risk of COVID-19 at pre-entry, point of entry and post-entry?

² In the context of system thinking, the “shipping system” can be viewed as a collection of interacting elements functioning with the overall goal of transporting the world trade.

However, such systems are considered soft systems with blurred boundaries. The study would provide an option to clarify the elements inside this large social system.

- How can biosecurity measures in ports be improved to strike a trade-off between protection of public health and economic development?

1.4 Research Methodology

Firstly, a literature review was done on key biosecurity terms, the role of ships in the spread of diseases, and the relationship between coronavirus and shipping. The review used documents and articles from websites of maritime administrations, Intergovernmental Organizations, and shipping journals, as well as google scholar.

The literature review provided the researcher with the necessary background knowledge to identify research questions and identify the appropriate research methodology.

The qualitative approach was selected to achieve the objectives of the research, which was mainly investigative and descriptive (Devers & Frankel, 2000). Further, the qualitative case study was chosen due to its strengths in answering how and why research questions, in order to describe a phenomenon (Hodkinson & Hodkinson, 2001). It also takes into consideration the interrelating nature of variables in a particular event (Cronin, 2014).

The case study utilized qualitative data from both primary and secondary sources to provide an overview of the impacts of COVID-19 on the shipping industry and to examine the biosecurity measures implemented in ports by the different nations.

To accomplish the objectives, two separate data collection methods and analysis were chosen as seen in **figure 1**, document review and structured surveys. Both methods are commonly used in qualitative research (Palmer & Bolderston, 2006).

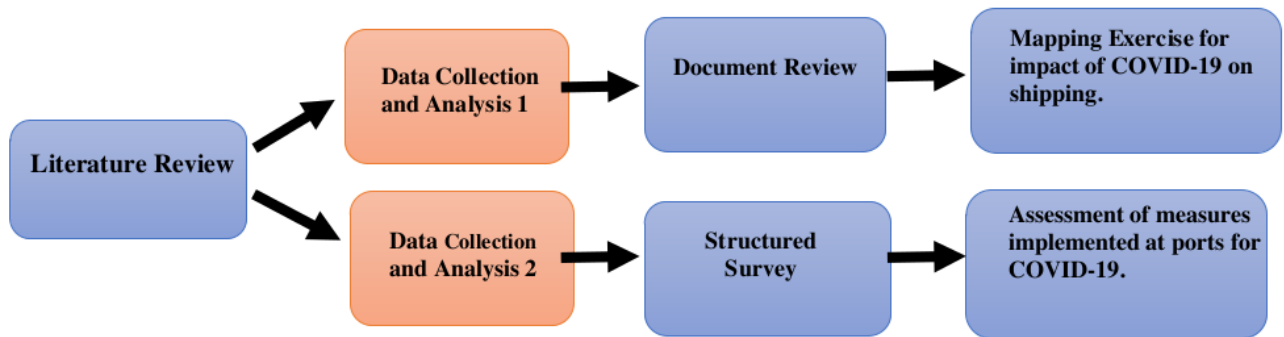


Figure 1 Overview of Research Methodology (Source: Author)

Due to the dissertation being lengthy, the complete description and justification of the methodology for both approaches are found in **appendix 1**. This includes additional information such as advantages of methods, ethical considerations, and limitations.

1.4.1 Data Collection

Document Review

The 1st data collection method of document review gathered and processed large quantity of documents. This method was chosen due to documents being readily available in online sources, as well as it being a time and cost-efficient process (Bowen, 2009).

The mapping exercise was able to provide an overview of the impact of COVID-19 on shipping. Data collection for the mapping was a continuous process as the study was focused on an ongoing event, the Coronavirus pandemic.

- The documents were gathered from the websites of relevant intergovernmental organizations, NGOs, maritime administrations etc. These sources were chosen as

they were able to provide circular letters, official press releases, reports and other documents from the regulators, top news shipping journals and research bodies (e. g Clarksons).

- Documents have been compiled from 1st January 2020 to 15th August 2020.

Structured Survey

The 2nd data collection method, structured survey, was used to examine the specific biosecurity measures enforced in ports for COVID-19.

The structured survey or questionnaire is a document designed with a consistent set of questions in a fixed layout that details the exact order and wording of questions for gathering data from participants (Cheung, 2014).

It was chosen since it would help in answering research questions by eliciting answers for the same questions from all respondents.

- An interactive survey was issued to WMU students working in maritime administrations and having access to port authority of their country. The students are from the 2020 MSEA and PM specializations. Participants were selected through purposive sampling based on their experience (Cresswell & Plano Clark, 2011; Sargeant, 2012).
- The intent of the survey was to collect data related to the measures taken in ports to address COVID-19. The structured survey had both closed and open-ended questions and was issued to participants individually. Open ended questions allowed for deep and meaningful responses (Palmer & Bolderston, 2006; Sargeant, 2012). It allowed recipients to highlight unique and key features of their country's biosecurity program.

1.4.2 Data Analysis and Presentation

Analysis of case study data may begin during the data collection process and continue throughout transcription, where recurring themes, patterns, similarities, difference and categories become evident (Creswell & Poth, 2016).

Descriptive level analysis of the data gathered was done using the ATLAS.Ti software for both data collection methods.

Literature Review

To conduct the literature review, the documents were explored using codes of specific words and phrases selected by the researcher (e.g. globalization, shipping, coronavirus outbreak on ships). The coding allowed for ease of browsing through large volumes of documents (Barry, 1998) and identifying each source where the coded term was located (Smit, 2002). This assisted to maximize efficiency and build a solid review.

Document Review for Mapping Exercise

For the mapping exercise, the documents uploaded were categorized based on focus (e.g. Seafarers, Technology, Regulators, etc.).

Key information were extracted from the documents by seeking answers to the research question through rigorous analysis (Palmer & Bolderston, 2006). This was done to explore the impact of COVID-19 on the key components and their relationships by creating group codes and further sub-codes. This was visually displayed using the network analysis tool of the software to show patterns, themes and concepts (Paulus & Lester, 2016).

Structured Survey

The responses from the structured survey were compiled onto an excel sheet and imported into ATLAS.ti.

The responses of the survey were explored using features of the software such as group coding (Smit, 2002). This allowed for grouping responses based on similar criteria such as question number, country of respondent and/or type of responses (e.g. for Yes or No questions). Responses were exported into tables on excel sheet using the group code feature for ease of presentation and discussion.

1.5 Organisation of Research

This research paper is currently structured into five chapters.

- Chapter One provides a background to the research topic and provides its context. This includes the significance of the problem, research questions, aims and objectives, as well as a brief description of the research methodology
- Chapter Two presents the results of the document review/mapping exercise and discusses the impact COVID-19 has had on shipping. The mapping also underscores the port as an important site of biosecurity measures.
- Chapter Three is biosecurity approach in ports. This section explores the concept of biosecurity, bio surveillance and sites of biosecurity practice. It introduces a framework to describe and organize biosecurity practices in ports. It discusses the international standards regulating health risks in shipping and those developed specifically for COVID-19.
- Chapter Four discusses the data gathered from the structured surveys. This method was used to better understand national response to the COVID-19 pandemic, the

challenges in implementing measures, as well as highlighting the unique and common approaches taken by governments at pre-entry, point of entry and post entry at ports.

- Chapter Five concludes the research paper by providing an overview of key findings from the data collected and analysed during the case study. Also it provides a list of good practices for developing a coordinated international response for managing the threat of infectious disease in maritime trade through a uniform framework.

CHAPTER TWO

DOCUMENT REVIEW TO MAP THE IMPACTS OF CORONAVIRUS ON THE SHIPPING INDUSTRY

2.0 Introduction to Chapter

According to Lloyd-list Half Year Outlook 2020, the “pandemic has devastated almost every segment of the shipping industry” (Lloyds List, 2020, page 1). Therefore, the objective of this chapter is to verify what extent the COVID-19 pandemic has impacted shipping.

Further, after the presentation of the global mapping, the following section will highlight notable elements for each of the key components at level 1. This was summarized into bullet points with references.

Due to COVID-19 being a new and ongoing event at the time of writing. Very few authoritative and peer-reviewed sources were available on the shipping sector’s impact. Therefore, the references used in this chapter were selected from the 712 documents reviewed by the researcher and supervisor. As it was impractical to list all the 712 reference documents used to prepare the mapping.

2.1 Document review

Document review was used to sort and interpret the documents. The documents were gathered from bodies that are responsible for the development (e.g. IMO, ILO, WHO) and enforcement (e.g. maritime administrations) of international standards, as well as top

shipping journals publishing the latest statistics and news (e.g. Lloyds List, Tradewind, Safetyatsea and Clarkson).

The documents collected were explored using the interview technique, whereby the researcher asked the research question and sought answers in the document treating them similar to a respondent (Bowen, 2009; Palmer & Bolderston, 2006).

Therefore, to answer the following research question:

1. How to map the impacts of COVID-19 on shipping? How this map could present/describe the shipping system?

Key information in the form of words, phrases and sentences were extracted from the documents³. The extracted data was coded into the ATLAS.ti software to identify and display COVID-19 impacts on the key components.

2.1.1 Data Presentation

The key components of shipping were summarized into 12 general categories and coded in **blue**.

The impact of Coronavirus on each component was described in detail by coding the information into different levels. As the levels increased the more details were identified for an impact. Level 1 was coded as **orange**, level 2 **green**, level 3 **red**, level 4 **purple**, and level 5 **grey**.

An example of the coding levels is depicted in **figure 2** which highlights the impact of COVID-19 on the Maritime Education and Training (MET) component, which led to the

³ See **appendix 3** for the list of document sources and number of files from each.

use of online training (OT). The data was presented using the network analysis tool of ATLAS.ti.

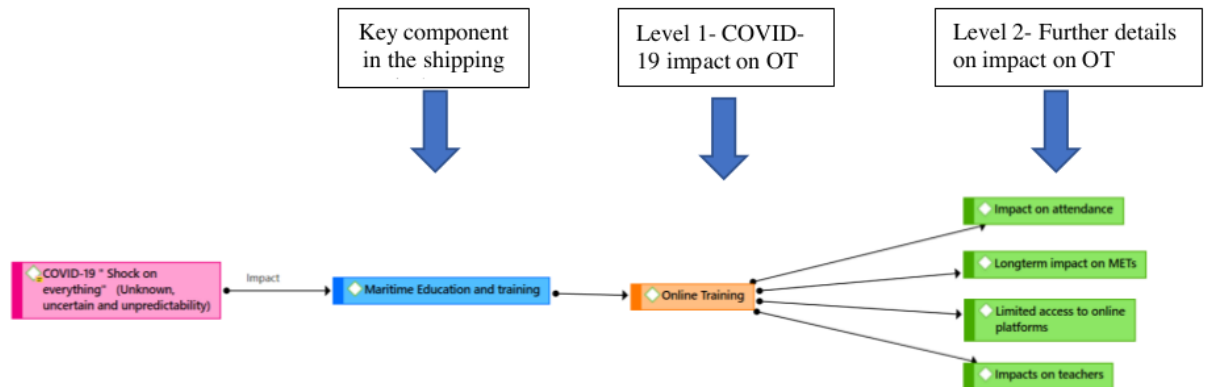


Figure 2 An extract from the "Mapping of the impact of COVID-19 on the shipping industry" for MET (Source: Author)

A total of 384 codes were used in this mapping exercise: **94 codes at level 1**, **140 codes at level 2**, **114 codes at level 3**, **22 codes at level 4** and **2 codes at level 5**.

2.2 Summary of COVID-19 impact on Shipping

Maritime shipping has managed to remain operational throughout the coronavirus outbreak, keeping the life blood of global trade and essential supplies flowing (AGCS, 2020).

However, the impact of the novel coronavirus on shipping has surpassed that of the previous 21st century emerging infectious diseases (Pham & Luengo-Oroz, 2020).

The Coronavirus pandemic being a “shock on everything” (Olser, 2020a), is depicted in **figure 3** below.

The mapping underscores the magnitude of the effect COVID-19 has had on each of the key components of shipping.

The mapping summarizes to a certain extent (in consideration of source number limitations and time since it occurred during the crisis) the impact of COVID-19 on the different segments of shipping and provided examples.

The mapping also highlighted the intertwined nature of the industry and how certain challenges (e.g. crew change), adaptation strategies (e.g. changes in transport contract) and interest (e.g. decarbonization) can be shared between and amongst components. The mapping also emphasized how the activities in one component (such as Ports) can amplify or lessen challenges faced by another.

Further, a selection of COVID-19 impacts on each level 1 components is examined in **section 2.3**. Additionally, the **appendix 3** contains the level 1 extract of the mapping for further reference.

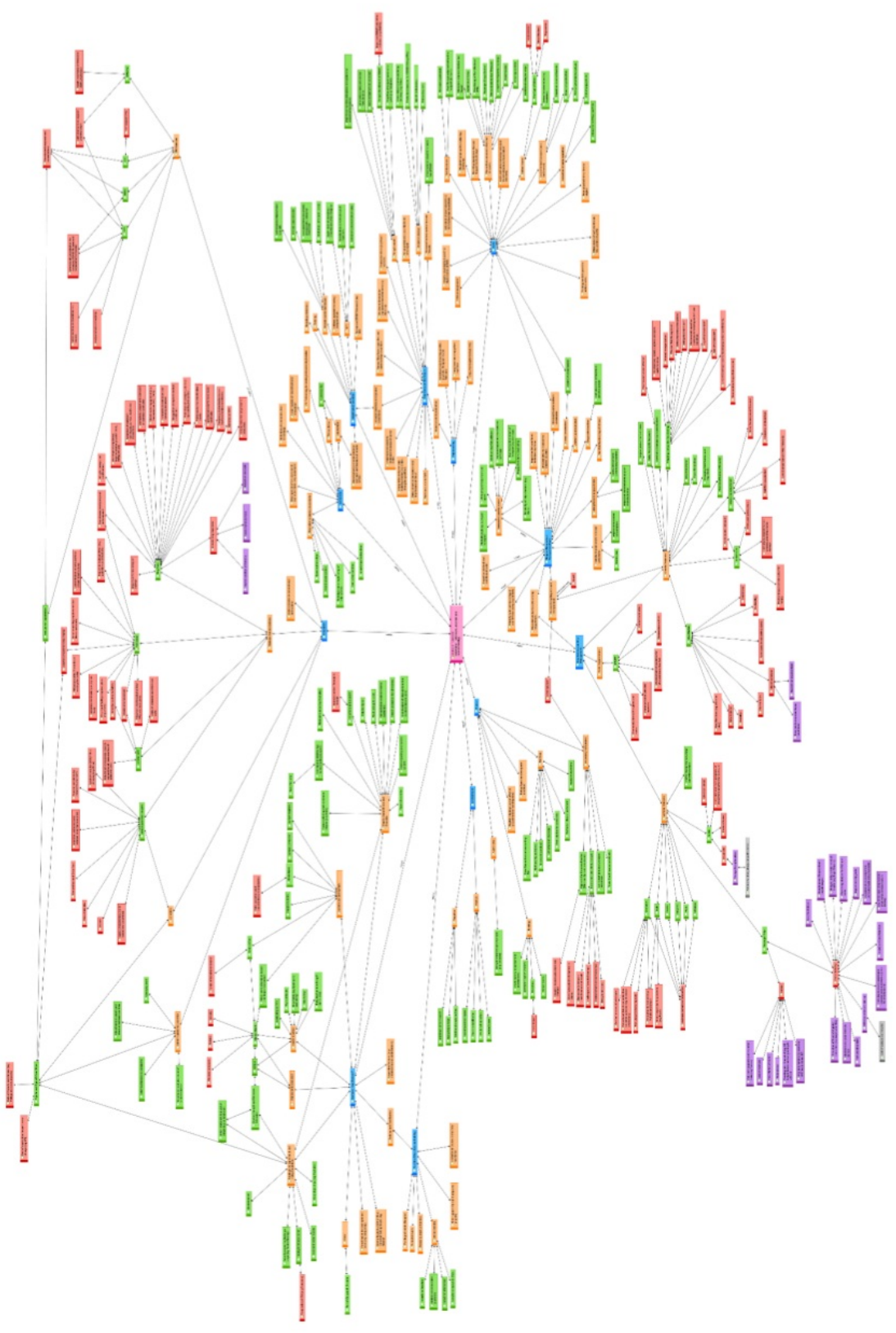


Figure 3 Coronavirus Pandemic Impact on the Maritime Shipping (Source: Author)

Impact of COVID-19 on Key Components of Shipping

2.3 Introduction

Understanding the difficulty to read the global map in **section 2.2**. The following sections will present a selection of elements to consider for each of the level 1 components coded in **blue** on the overall network map of the “Impacts of COVID-19 on Shipping”.

2.3.1 Regulators

Introduction

Regulators are tasked with the responsibility to develop (e. g IMO), as well as enforce and ensure compliance with international standards (e. g Flag State).

The normal application of these regulations has been disrupted by the current crisis. Therefore, regulators have reacted on different levels to minimize the impact of COVID-19 and ensure shipping operates safely.

International Level

- The main entities at the international level are the United Nations agencies and organizations: IMO, ILO, WHO and UNCTAD.
- These UN agencies collaborate to respond to several challenges brought on by the current COVID-19 pandemic, particularly in the case of repatriation and shore leave for seafarers (Circular Letter No.4204/Add.14 and .23).
- Further, guidance for response measures and operational considerations during the COVID-19 outbreak were released jointly and individually by IMO, WHO, ICS , WCO⁴ etc (Circular Letter No.4204/Add.2,,3,,4,,5,,6,,7,,9,,10,,11,,13,,15,,16,,19 and revisions).

⁴ See Abbreviations table

- IMO and UNCTAD released a statement emphasizing the importance of trade and state cooperation for maintaining supply chains (circular Letter No.4204/Add.21).
- Several technical meetings by these agencies had to be postponed (e. g 75th meeting of the MEPC, IMO Circular Letter No. 4213/Add.1).
- The meetings that did occur were held remotely (e.g. meeting with Port State Control Regimes via video conferencing (IMO circular Letter No.4204/Add.8).

Regional Level

- The European Union (EU) has been one of the bodies supporting the repatriation of seafarers. This support was demanded from the European shipowners and seafarers association (Adamopoulos, 2020c).
- Additionally, EU Associations, Clecat and Feport, has warned over market distortions caused by state support such as a special tax regime for cargo-handling activities offered by the EU (Baker, 2020a).

National Level

The flag State, port state and coastal state has had to implement measures to prevent the spread of COVID-19 as well as adapt special operational considerations.

Flag State

- Flag states are currently facing challenges in meeting their obligations to ensure ships are in compliance with the mandatory international regulations.
- Flag states have taken different positions on the delay of surveys, audits and extension of certifications (Wimmer, 2020). (e.g. Comoros, Ref No. 20/01855/COM, Bahamas- Technical Alert 20-03, Dominica- CD-MS-C 02-20, Rev01, Cyprus Circular-No. 08/2020, Sri Lanka- MSN 02/2020, Marshall Islands –Advisory No. 14-20, Netherlands- Circular 034/2020).

- Alternatives have been used to cope with the conditions brought on by the pandemic through the issuing of interim statutory certificates (ISM, ISPS, MLC, 2006), provision of exemptions for the minimum safe manning documents, the use of electronic certificates (Corbett, 2020a) etc.
- Notably, many flag states issued circulars advising of extensions of SEAs (Barbados, CD-MSC-2-20, Australia Marine Notice 04/2020).
- Also, efforts have been directed to the use of remote flag inspection (e.g. Liberia had conducted its Annual Safety Inspection (ASI) remotely via video (Twining, 2020c).

Port State Control (PSC)

- Many PSC's have had to limit onboard inspections (Olser, 2020a). However, PSC officers have still been able to capture violations such as invalid Seafarer Employment Agreements, which have gone beyond the 11 months maximum (e.g. Panama) (Olser, 2020c).
- Governments/ PSCs have also put in place restriction and precautionary measures at ports to prevent the spread of COVID-19 (e.g. India, Order No.04)
- Also, entities such as the US Coast Guard (USCG), have communicated numerous standards or requirements that must be met when calling to ports to ensure maritime traffic systems keep flowing safely (e.g. USCG MSIB 06-20 reporting requirements for sickness and USCG MSIB 12-20 Vessel and Facility response plan).

Coast State

- Coastal states have supported port states in enforcing restriction measures. These measures have been an obstacle to movement and delay of salvage operations (e.g. Golden Ray salvage) (Jiang, 2020).

- Coastal state are facing challenges in SAR operations, i.e. delays in emergency response (Allianz, 2020).

State Support

- States have also offered different types and level of support to alleviate challenges brought on by the current crisis (e.g. the MPA of Singapore and the Singapore Maritime Officers' unit has launched COVID-19 relief packages for seafarers unable to secure shipboard employment (Li, 2020; Martina, 2020b).

Conclusion

The major element for regulators that have been impacted by the COVID-19 pandemic is the application of international instruments (MLC, 2006, STCW, SOLAS etc).

Several other challenges have risen due to the diversion from the normal application of these international standards. A notable example is the extension of Seafarer's Employment Agreement (SEA). It has exacerbated the challenges for seafarer health and wellbeing, as well as the overall safety of shipping.

2.3.2 Classification societies

Introduction

Classification societies, along with other key components such as regulators, must at some point have direct contact with ships. This contact has been limited due to the various travel restrictions enacted by governments and the rapid person to person spread of the disease.

- Classifications Societies have had challenges in carrying out statutory surveys and inspections at some ports (Allianz, 2020).

- Each classification society have made efforts to adjust to the pandemic (e.g. temporary amendment of rules) (Corbett, 2020a).
- Societies have made attempts to adapt to the current situation by moving towards digital solutions such as E-certificates and remote survey (Lloyds List, 2020b; Meade, 2020a).
- IACS⁵ has introduced a uniform approach towards justified postponement of surveys and inspections (Adamopoulos, 2020a).

Conclusion

The normal operation of classification societies has been interrupted by COVID-19 and measures have had to be in put in place to overcome the challenges to carry out surveys and inspections (e.g. remote survey).

2.3.3 Shipyard, Ship Repair and Ship Breaking

Introduction

The economic destruction COVID-19 has had on national economies has limited finance and increased operational challenges for shipyards, ship repair and ship breaking.

Shipyards

- The demand for shipyards has decreased as result of the slowdown in shipping activities (Lloyds List, 2020a).
- New building orders for 2020 are at its lowest in the past 50 years (Meade, 2020b).
- Notably, European shipyards specializing in the construction of cruise ships, ferries and offshore vessels are facing empty order books and some have had to

⁵ IACS set standards for member societies that cover 90% of the world's cargo-carrying ships' tonnage (IACS, 2020).

completely close down, such as Fincantieri in Italy (Lewis, 2020b) and Meyer Werft in Germany (Lewis, 2020a). This decrease in demand has increased competition between ship building nations (e.g. china had strengthened the position) (Sharpe, 2020a).

- However, even for orders that have been placed, shipyards have had delay in works due to issues with suppliers and equipment providers. This is compounded by shortage in staff (Allianz, 2020; Ang, 2020).
- This has also resulted in the delay instalment of scrubbers, BWMS and special propulsion systems (Hine, 2020).
- IMO has acknowledged the challenges faced by shipyards in meeting delivery dates and provided guidance in this regard (Circular Letter No.4204/Add.7).

Ship Repair

- Travel restrictions have created challenges for specialty engineers to access ships for scheduled repairs (Shen, 2020) (Clarksons, 2020).
- Ship owners and Ship management companies have had to delay, postpone, or cancel ship repairs (Shen, 2020).

Ship Breaking

- Lockdown in countries have brought ship breaking activities to a complete stop for months (e.g. India, Bangladesh and Pakistan) (Walia, 2020).
- This has impacted steel production and will potentially lead to long term low scrap prices (Walia, 2020).

Conclusion

Shipyards, namely those centred on passenger ships, have had a complete downturn in order books from the previous years. Likewise, for ship repair and ship breaking, a

slowdown in shipping activities and reduced or rerouted finance has impacted their demand.

However, if ships are not repaired timely, this contributes to the health and safety of crew and shipping at large.

2.3.4 Ship Owners and Ship Management Companies

Introduction

Ship owners and ship management companies from the various shipping sectors are having both shared (generic) and sector-based experiences during the current pandemic.

The shared experiences are mostly centred around the shore-based section of their operations. For the different sectors, the scale of impact and magnitude of recovery is varied.

Generic

- COVID-19 has disrupted the normal operation of ship companies across the board, which has led to adjustments such as changes in ownership (primarily impacting small owners) (Nightingale, 2020).
- Shipping companies have had to layoff of both shore and sea staff (Dixon, 2020), conduct internal reorganization and adjust to office/workflow disruption (Clarksons, 2020).
- They have also had issues in ensuring the timely repair of ships (Meade, 2020a; Shen, 2020), providing adequate supplies and spare parts (Twining, 2020d) as well as challenges in planning for the future in terms of investments and new building (Clarksons, 2020).

- Shipping companies have also had to cope with trade line adjustments such as changes in departure frequency, adjustment in canals fees such as the Suez and the suspension of port calls (Bush, 2020).
- In regards to environmental regulations, the coronavirus pandemic has impacted decarbonization of the shipping industry (Lloyds List, 2020d). The decrease in bunker fuel demand as predicted by IEA and the lower prices for low sulphur fuel has had a positive impact on IMO's goal to reduce air pollution from shipping (Lin, 2020).
- However, Mr Jan Dieleman, from Cargill head of ocean transportation, have highlighted that drop in oil prices can hinder the choice of cleaner technologies (Adamopoulos, 2020).

Sector Based

For sector-based experience, the different classes of ships in the merchant fleet is been impacted differently.

Bulk Carriers

- Dry bulk market has weakened due to COVID-19. Particularly as result in the disruption of Brazilian iron ore and slowdown in many countries' industrial activity (e.g. China) (Clarksons, 2020).
- The dry bulk market may face further contraction in global demand by up to 3% from July to December (Allianz, 2020).

Container Ships

- The container market has seen the largest fall since the 2008-2009 financial crisis (Lloyds List, 2020a), with larger negative impact than dry bulk (Clarksons, 2020).

- The coronavirus is seen as one of the biggest challenges for even the strongest container shipping lines (Nightingale, 2020).
- Furthermore, Container lines are at risk of potential bankruptcy (e.g. MPC containers (Adamopoulos, 2020b)).

LNG/LPG ships

- Low demand and additional number of newbuilding LPG tankers to be added to the market is having an impact on LNG/LPG market (Lloyds List, 2020a).

RO-RO Vessels

- COVID-19 has disrupted car production and weekend the demand due to weaker economy and consumer confidence (Clarksons, 2020)
- Ro-Ro companies such as DFDS in Denmark has had to suspend passenger activity potentially leading up DKK 1.6bn in losses if services aren't resumed timely (Birkett, 2020).

Offshore Vessels

- Major shock to offshore vessel operations. COVID-19 has the potential to reduce to reverse all recent gains (Clarksons, 2020).

Ferries

- For passenger ships, ferries have seen cancellation and loss in revenues (Baker, 2020b; Clarksons, 2020). Example, ferry link between Japan and China cut (Wainwright, 2020).
- Crossing rules had to be adjusted, for example freight drivers and car passengers to stay in vehicles (Martina, 2020a).
- Passengers of Ferries would also be required to wear PPEs (E.g. Seoul) (Martina, 2020a).

Cruise Ships

- The cruise industry has had a complete shutdown leading to an array of issues for this sector and other key components such as shipyards.
- This may become one of the most complex bankruptcy in history (Coyne, 2020a), with increased liability (Allianz, 2020).
- Cruise ship crews have been stranded and unpaid (e.g. MSC Seaview) (Bartlett, 2020a), crews have had hunger strikes, committed suicides and subjected to mental health issues (Ito et al., 2020).

Tanker Vessels

- COVID-19 heavily impacted oil demand at global level (Ahmad et al., 2020) , from the disruption in low oil prices (Clarksons, 2020)
- Therefore, the tanker market has remained mostly operational with special cases of storage exceptionalism (e.g. in mid-May 200 million barrels of oil was on floating storage). These floating storages face extreme weather, piracy and political risks (Allianz, 2020) .

Trade Organizations

- Trade organizations have developed and shared guidance documents for ship operators (e.g. Circular Letter No.4204/Add.26-Guidance on the gradual and safe resumption of operations of cruise ships).
- ICS and ISF have also coordinated with other agencies such IATA and ITF (Austin, 2020).

Conclusion

Ship owners and ship management companies share generic problems such as challenges in the management of offices, labour, allocating finance for vessel repair and maintenance etc. However, other major generic issues exist such as decarbonization.

Furthermore, all sectors have seen a downturn or decline in operations. In particular, the cruise industry has almost completely shut down, which has had other unprecedented impacts on crew and possibly one of the biggest bankruptcies in history.

2.3.5 Shippers/Forwarders/Transporters and Trade

Introduction

The current COVID-19 crisis has slowed down trade (Ahmad et al., 2020). Therefore, as supply chains come under strain shippers, forwarders and transporters have had to adjust operations to effectively function in the current environment.

Trade

- Seaborne trade is currently at the lowest since the last 35 years (Clarksons, 2020).
- A transport capacity crunch has resulted from an increase in blank sailings (Murphy, 2020), decrease in empty container availability and decline in port calls (Clarksons, 2020).
- These factors have directly impacted shippers, forwarders, and transporters and limited their ability to plan (short, mid and long term) (Dixon, 2020).

Forwarders and Transporters

- The extended delivery times, cargo deterioration (high value and temperature sensitive goods), tax modifications and changes to cargo delivery procedures

(Rozas, 2020) etc have created challenges for forwarders and transporters with shippers.

Shippers

- Shippers have made insurance claims due to delivery delays and cargo deterioration (Osler, 2020), which also increased in charter party disputes (Sumption, George, 2020).
- Positively, some shippers have paid over the odds to ensure cargo is being transported in light of blank sailings and frequency of departure (Lloyds List, 2020a).
- They have also played a helpful role in the crew change crisis, as shippers are not chartering ships with crew that have been serving long periods of time (Lowry, 2020a).

Conclusion

The normal relationship between shippers and transporter/forwarders were impacted due to the transport capacity crunch. As the pandemic has slowed down shipping activities, issues such as cargo deterioration occurred more frequently, which has initiated court actions such as charter party disputes.

2.3.6 Finance

Introduction

The current crisis has caused financial strain for ship management companies which is compounded by increased liabilities and court claims.

Consequently, bankers are also hesitant to new lending. Insurance companies and P&I clubs have had to adjust operations under the additional workload.

P&I Club

- The COVID-19 outbreak has caused an increase in workload for P&I club employees causing them to become overworked; developing anxiety and stress (Allan, 2020; Olser, 2020d).
- Liabilities resulting from seafarers becoming sick with COVID-19 and death are covered but considered a painful claim cost for P&I clubs (e.g. Standard Club) (Corbett, 2020b; Olser, 2020b).
- Mental health and physical issues faced by seafarers are anticipated to result in increased liability implications (Clayton, 2020b) (Bockmann, 2020).
- Breaches of the MLC, 2006, where restrictions on crew exchange keep seafarers employed beyond their contract terms, may be considered on a discretionary basis by most P&I clubs (Corbett, 2020b).

Insurance

- For insurance companies the coronavirus pandemic has been the costliest event, with an anticipated health impact similar to that of the 1918 influenza pandemic (Sperry, 2020).
- This has led to an increase in claims filed at court due to issues such as delay in maintenance, repair and force majeure due to contracts not being fulfilled between shippers and ship owners (Lloyds List, 2020a; Sumption, George, 2020).
- Due to the containment measures in place, there has been postponement in hearings, delay in decisions and challenges when conducting remote hearings (Carter, 2020).
- Insurance companies have had to find creative ways of managing this using method such as geospatial intelligence (Vincent, 2020b).

- Positively, an increase demand for reinsurance was anticipated for June and July according to John Dacey, Swiss Re's chief financial officer (Vincent, 2020a).

Banking

- Most shipowners purchase ships through loans from banks, but in light of the ongoing pandemic the credit and risk departments of banks face many uncertainties in supporting new lending (Lowry, 2020b).
- Some shipowners have had to seek alternative finance vendors. Greek banks are one of the few banks that have are still offering lending services (Lowry, 2020b).

Other

- English shipping courts adjusted quickly to minimize disruptions cause by the pandemic, through measures such as remote hearings (Sumption, George, 2020).

Conclusion

The major impact COVID-19 has had on finance is the sourcing of new banks, increased workload for P&I clubs which have impacted physical and mental health of staff and the increased claims filed at court (e.g. violation of SEA).

2.3.7 Environment

Introduction

One of the more positive impacts COVID-19 has had is on the environment. Despite the changes in type of waste present on beaches (i.e. less plastic more medical waste) it has been less.

Positive

- Governments implementing lock down measures have had a positive influence on the environment. A study done by Gonzalez and Rodas (2020) has highlighted that there is a reduction of garbage pollution, noise pollution and hydrocarbons spillage on beaches.
- This resulted in reestablishment and increased activity of marine species on beaches such as turtles, manta rays and whales (Ormaza-González & Castro-Rodas, 2020).

Negative

- Instead of the usual items normally found on beaches the volume in plastic bottles seen has increased. Probably because of less potable water.
- The increase use of PPEs is also evident in waste streams. As an increase in medical waste is seen deposited on beaches (Ormaza-González & Castro-Rodas, 2020).

Conclusion

Border closures and shutdown of nation-wide economic and social activities have led to countries reporting cleaner water, less garbage on beaches and return of marine species.

2.3.8 MET and Technology

Introduction

Maritime Education and Training (MET) has traditionally been based on in person learning and practical activities. However, this approach has been a challenge in the new

COVID-19 environment. Efforts have been made to overcome these challenges using digital technology.

The use of digital technologies has also been propelled as an adaptation strategy for other components such as regulators, shipyards, and ports.

Maritime Education and Training (MET)

- MET has moved to technological solutions such as online platforms to address issues such as school closures and disruptions to training schedule, as well as limitations in providing practical training (Lloyds List, 2020a).
- However, online training has had challenges due to teachers learning to adjust to this new alternative and the limited students that can access online sessions (Clayton, 2020a).
- This will potentially have long term impacts on MET (Clayton, 2020a).

Technology

- The world is currently going through its 4th industrial revolution and the move towards digitalization has been catapulted due to the restrictions cause by the current pandemic (Lloyds List, 2020b).
- Technology has therefore become indispensable/invasive for the effective operation and management of the shipping industry (IMO Circular Letter No.4204/Add.20, Sharpe, 2020).
- Technology is still seen as a possible solution and interest have been shown to possibly deploy innovations such as low carbon solutions, automated ships, hybrid power systems, speed optimization and redesigning ship systems(Lloyds List, 2020d). Also, the expanded use of telemedicine (Arralde, 2020).
- Technology can also be used to develop risk assessment tools for regulators to facilitate crew change (Coyne, 2020a).

Conclusion

Technology is being used to overcome challenges in MET due to disruption in classes. However, this has led to other limitations such as teachers not being able to adapt to online mediums for lecturing and students not being able to afford laptops or tablets.

Additionally, technology is also facilitating the move towards decarbonization among an array of solutions for other components such as regulators and ports.

2.3.9 Ports

Introduction

Normal operations of ports have been interrupted by COVID-19. Issues such as the supply of labour and inland transportation has led to bottleneck of cargo in ports.

Furthermore, ports are functioning as the site of quarantine and restriction measures for managing COVID-19 from shipping (Meade, 2020a).

Port Operations

- The daily operation of the port has been directly impacted by the outbreak of the disease. This is evident in shortage of labour reported such as truck drivers, dock workers and tug workers (Sharpe, 2020b).
- Issue with labour and lack of inland transportation have led to Port bottle neck. This is compounded by suspension of port calls and adjustment in port charges (Sharpe, 2020b).
- COVID-19 have also led to complete port closures in some countries (Corbett, 2020c).

Quarantine Communications and Measures

- Quarantine measures in ports includes but is not limited to mandatory ship disinfection, screening of crew, health monitoring of port workers, provision of PPEs and vessel quarantine (Martina, 2020c; Meade, 2020a).
- An example of this is seen in Namibian ports, whereby “any vessel calling at Namibia will have to provide background documentation to the Ministry of Health and Social Services (MoHSS) about the last port of call, the number of passengers, and general conditions on board” (Botha, 2020, para. 2).
- Also, the quarantine of a tanker in Antwerp due to 15 of 26 crew being COVID-19 positive (Twining, 2020e).
- In some case the extra checks, verification, and requirements in place at ports can lead to delays for ships (Ang, 2020) (Dixon, 2020).
- Further, the measures implemented in ports have limited or completely banned shore access for seafarers (Clayton, 2020b; Stokes, 2020).
- Surveyors have also been denied access to ports (IMO Circular Letter No.4204/Add.19).

Industry Organizations

- According to Circular Letter No.4204/Add.12/Rev.1, the Port Authorities Roundtable have agreed , “20 PAR members from Asia, Europe, the Middle East and North America came together on 24 April 2020 in Singapore to declare their commitment to ensuring their ports remain open amidst the current pandemic (page 1, para. 2).
- Furthermore, as a possible solution to the issues present at port, industry organizations have pushed for digitization of ports to limit physical interaction of ship and shore personnel (IMO Circular Letter No.4204/Add.17).

Conclusion

Apart from the effects COVID-19 has had on port operations, it has emphasized its role in shipping as the site for measures imposed on ships to prevent the spread of COVID-19. The measures implemented have impacted crew, inspectors, surveyors etc.

2.3.10 Seafarers

Introduction

The challenges faced by seafarers have been compounded by COVID-19 (Twining, 2020b). Issues such as the mental health and fatigue of seafarers was already a discussion topic at the IMO prior to.

Therefore, the industry is considered to have a “ticking time bomb on its hand” with the seafarers crisis (Lloyds List, 2020c).

Employment Agreement and Living Condition

- One of the major impacts of COVID-19 was on seafarer sign in/ sign off due to coronavirus travel and quarantine restrictions (Twining, 2020b).
- Statements were released emphasizing that “enough is enough”, crew change not being allowed is an injustice to seafarers (ITF, 2020).
- The restrictions in seaports and closure of airports have led to over “100, 000 seafarers to be marooned at sea” according to the alliance of leading shipowners and managers in April 2020 (Meade, 2020, page 1, para. 5).
- Therefore, some Flag states have extended tours beyond the stipulations of the legally binding MLC, 2006 (i.e. 12 months maximum), some even as long as 17 months such as Panama (Olser, 2020c).

- The IMO has provided a 12-step plan for member states to reduce restrictions and facilitate the sign in and off for crew from ships (Circular Letter No.4204/Add. 14).
- On 26th May 2020 IMO, ICAO and ILO released joint statement requesting the designation of Seafarers, among other marine personnel, as key workers (Circular Letter No.4204/Add. 18).

Health and Safety

- Extended contracts is contributing further to health and safety challenges faced by seafarers, such as fatigue and mental health issues (Clayton, 2020b). The extended work periods can lead to more accidents at sea (Allianz, 2020; Lloyds List, 2020c) and suicides (Berrill, 2020).
- The financial pressures from families have also contributed to these issues along with the “unknown” about the future (Stokes, 2020).
- Other pronounced health and safety issues that have risen include challenges in obtaining PPEs, spare parts for ship safety (Bartlett, 2020b). Fortunately, companies such as GENCO, has provided PPEs and safety trainings (Bakhsh, 2020a).
- Even for seafarers whom are not able to sign on and start contracts, are without pay and not able to provide for their families (Stokes, 2020). This has affected their mental health and wellbeing as well (Adamopoulos, 2020; Twining, 2020b).

Health Care and Welfare

- A survey was done by ICS and ITF on health protection measures on board ships in response to the coronavirus pandemic (Circular Letter No.4204/Add.25).
- Other studies, such as the seafarer’s happiness index, which has reported a drop from 6.39 to 6.30 in 1 year, has highlighted issues from extended contracts, lack

of shore leave and not being able to access welfare facilities onshore (Twining, 2020b).

- Similarly, a survey launched by a University in Croatia to identified the impact of COVID-19 on crew wellbeing (Blake, 2020).

Charity, Trade Unions and Churches

- Several charities, trade unions and organizations have stepped in to help alleviate some of the issues and challenges faced by seafarers.
- An example of this is an effort launched by the Royal Merchant Navy Education Foundation (RMNEF) and the Fishermen’s Mission (FM) to aid children of seafarers with educational support packages (Twining, 2020a).
- The Pope have also offered support to seafarers through words of encouragement and care packages from the Mission to Seafarers charity (Bakhsh, 2020b).
- The Joint Negotiating Group (JNG) and the International Transport Workers Federation (ITF) had launched a “Enough is Enough” campaign to address the issue of crew change and importance of facilitating this process (ITF, 2020).

Conclusion

The level 1 component “seafarers” are the most heavily impacted by the COVID-19 pandemic, both directly and indirectly. Over 100+ out of the 700+ documents that were reviewed were focused on the impact of COVID-19 on seafarers.

The impact of COVID-19 has mostly resulted from the prohibition of shore access for crew change and the resulting extension of SEAs. Leading to fatigue, depression, stress etc, which has secondary effects of unsafe work practices, crew not willing to work (no cargo operations being carried out),

2.4 Conclusion of Chapter

The mapping exercise has clearly demonstrated the Coronavirus “shock on everything”. It has highlighted the many dimensions that have been impacted by COVID-19 and a few of the special measures that have been in put in place to adapt and overcome the challenges brought on by the crisis.

Additionally, this exercise enabled us to assess with a case study the extent of shipping as a system. Meaning many elements which are all connected making together the shipping system without any central control. This aspect of the mapping needs additional research using the system thinking approach.

Further, the mapping has pinpointed to the port being a key area/location that is being used to manage the threat of the disease from shipping. This is where countries have implemented stringent quarantine and inspection measures that have posed challenges for other key components of shipping.

Therefore, examining the measures implemented in ports can be useful in understanding the practices in place that may be impeding the movement of trade and persons during the COVID-19 pandemic.

CHAPTER THREE

BACKGROUND TO BIOSECURITY STRATEGICAL APPROACH IN PORTS

3.0 Introduction to Chapter

The mapping demonstrated that all segments of shipping are being affected by the Coronavirus pandemic. Notably, the port was underscored as the location for biosecurity measures to protect against the health risks from international ships.

Therefore, this chapter will explore the concept of biosecurity and bio surveillance in ports, as well as introduce a framework for organizing biosecurity practices at this site to prevent the introduction and spread of biohazards. Further, the international regulations and authoritative documents for managing COVID-19 in shipping will be highlighted.

3.1 Concept of Biosecurity and Bio-surveillance

Multiple events prompted the development of the term and concept of biosecurity in the early 2000s (E.g Mad Cow, HIV-AIDs, Post 9/11 Anthrax attack, globalization, Etc) (Dobson et al., 2013) (Meyerson & Reaser, 2002). However, before the existence of the term societies developed measures to protect human, animal and plant health. For example, from the middle ages quarantine measures were utilized in ports to secure biological resources from biohazards of any form (Pham & Luengo-Oroz, 2020).

Since then, the concept of biosecurity has evolved to include, inter alia, animal and plant diseases and pests, zoonoses, living modified organisms (LMO's), genetically modified organisms (GMO's) and food safety (FAO, 2007). Additionally, the concept covers the

intentional and unintentional introduction of non-native species that can cause harm to human health and the environment such as alien species introduced via ballast water.

Definition

Among many, the Food and Agriculture Organization (FAO) of the United Nations (2007) has provided an authoritative definition of biosecurity as “a strategic and integrated approach that encompasses the policy and regulatory frameworks for analysing and managing relevant risks to human, animal and plant life and health, and associated risks to the environment.”

Further, biosecurity recognizes that biological interactions can transcend sector’s boundaries (Dobson et al., 2013). For example, HAOP introduced through ballast water may affect aquaculture and human health. Unfortunately, each area is addressed by different agencies (i.e. in the example, aquaculture by fisheries department and human health by Ministry of Health), who may not coordinate their response.

Objective of Biosecurity

The overarching goal is to manage the intentional and unintentional risk to human and animal life and health both nationally and internationally by providing a common conceptual framework (FAO, 2007).

Traditional vs Integrated Biosecurity Approach

The basis for an effective biosecurity program involves collaboration across the different sectors: human, animal, plant, and environmental protection.

Traditionally, biosecurity measures are sector specific, namely quarantine, food safety, animal and plant health, human health, and environment protection (FAO, 2007).

Most countries, such as the United Kingdom (UK), still adopt this traditional approach. One country in the UK has several agencies and departments managing biohazards. There is one central government department (Defra), six executive agencies (which includes animal health), two ministerial departments, port health authorities, 149 local authorities and a large number of veterinarians in private practice (Donaldson, 2013). However, the short comings of this complex traditional structure with competing entities became evident.

Contrary, countries such as Australia, New Zealand, Belize and Finland began to move towards an integrated biosecurity program (FAO, 2007). For these countries, a single agency is responsible for managing all biosecurity risks.

In New Zealand, a primary legalisation had been adopted in 1993 which is managed by the Ministry of Primary Industries under the Minister of Biosecurity (Donaldson, 2013). This approach allows for better coordination among leading agencies for sharing resources, responsibilities, complimenting programs, joint initiatives, as well as laws and regulations with the objective of achieving set goals (FAO, 2007).

Further, the integrated biosecurity system is characterized by intersecting zones of activities to prevent the introduction of biological threats and if the system is breached, to eradicate and control the population (Dobson et al., 2013).

Risk Analysis in Biosecurity

The integrated biosecurity approach utilizes risk analysis, which was already embedded into each sector individually, acting as a unifying element in this regard.

Quality risk analysis is only possible through wide participation of stakeholders and therefore includes three elements actively working together- risk assessment, risk management and risk communication (FAO, 2007).

Bio-surveillance

The earliest health surveillance system were recognized during the plague (black death) in the 14th and 15th centuries (Daughton et al., 2017).

Today, bio surveillance focuses on avoiding any uncontrolled or unnoticed movement of hazardous organisms and pathogens.

Bio surveillance “is the process of gathering, integrating, interpreting, and communicating essential information related to all hazards, threats, or disease activity affecting human, animal, or plant health to achieve early detection and warning, contribute to overall situational awareness of the health aspects of an incident, and to enable better decision-making at all levels ” (NACCHO, 2015).

Surveillance can include both laboratory surveillance, which is the confirmation of diseases presence and syndromic surveillance which documents case counts without laboratory diagnosis based only on signs and symptoms (Huff et al., 2017).

Additionally, national biosecurity systems are supported by regional and international coordination to manage emerging risks, such as the monitoring of the reporting system for WHO (Huff et al., 2017).

3.2 Biosecurity Strategic Approach- Pre-Entry, Point of Entry and Post Entry

According to Dobson et al., (2013), biosecurity practices can be organized in different ways. "One way to understand the breadth of practice that makes up biosecurity regimes is to view practices and policies that act in and on different sites spatially arranged in relative proximity/distance from national territorial borders" (Dobson et al., 2013, page 10), particularly key point of entries such as ports.

Point of entry (POE) as defined by IHR (2005) is "a passage for international entry or exit of travellers, baggage, cargo, containers, conveyances, goods and postal parcels, as well as agencies and areas providing services to them on entry or exit".

In practice, the deployment of biosecurity measures and practices are developed around three axes at POEs, namely pre-entry, point of entry and post entry. Each site would have different levels of interaction (offsite and onsite) and focus (Dobson et al., 2013).

This framework is used by New Zealand's in its biosecurity strategy, which has arranged activities at pre-border, border, and post-border. It provides a uniform framework for how New Zealand responds and manages harmful organisms. This is detailed in the NZ Biosecurity Act 1993 (MPI, 2018).

Similarly, Australia is managing biosecurity risks at point of entries using pre, at and post distinctions. Biosecurity requirements and practices are detailed utilizing this framework in their Biosecurity Regulation 2016 (Australian Government, 2018).

The implementation of measures at the 3 layers, as evident in Australia and New Zealand, is effective for managing biosecurity risks created by the international movement of vessel, cargo and persons at POEs (Australia Department of Agriculture and Water Resources, 2016).

To achieve this, resources are allocated to each biosecurity site. Studies have emphasized that resources and manpower should be directed to prevention at pre-entry and point of entry. As response at post entry is more costly than prevention and is time sensitive (Westphal et al., 2008).

3.2.1 Description of Biosecurity Sites

3.2.1.1 Pre-Entry

Pre-entry is where most of the biological risks are managed prior to arrival at point of entries (Meyerson & Reaser, 2002), which in shipping are ports and terminals.

Objective and Focus

Prevention is the main objective of the measures deployed at pre-entry (Baumler, 2020). The purpose is to identify the risk before it enters the territory and shift the biosecurity threats offshore (Dobson et al., 2013).

Pre-entry measures aims to mitigate or reduce biosecurity risks from ships with adherence to international legislations (Dobson et al., 2013) when available. In shipping the requirement of the International Health Regulations (IHR 2005) are particularly helpful.

Practice- Assess the risk before arrival

Risk assessment will facilitate early detection and is used to justify measures that may restrict international trade and transport (Dobson et al., 2013).

Risk assessment and preventative measures are essential as later it may be difficult or impossible to treat and/or removed harmful organisms and pathogens (Harvey & Mazzotti, 2014).

Therefore, agencies in charge will anticipate the problems and take all necessary measures to prevent the establishment of pathogen and harmful organisms. This is done by qualified personnel that have been trained and have the necessary experience to identify biohazards (Baumler, 2020).

To assess the risks, the administration must collect data or information before arrival. Pre-departure inspection⁶ and pre-arrival declarations⁷ should provide the expected information needed to initiate a risk assessment (Meyerson & Reaser, 2002). The information collected is shared to carry out risk analysis and initiate measures to prevent

⁶ Pre-departure inspection includes the checking of goods and persons in departure ports, as well as developing import requirements, applications and risk assessments (Dobson et al., 2013).

⁷ Before arriving to a country's port, vessel operators and cargo owners must ensure that country specific health standards are also met (Bakanidze et al., 2010)

the introduction of biohazards (Dobson et al., 2013), such as pathogens and harmful organisms .

In New Zealand, it is called a pre-border risk assessment for existing and emerging biosecurity risks. This is used by the biosecurity agency to keep the risk offshore (MPI, 2018).

When the vehicle is cleared, and in the case of ships, “*Free Pratique*” is granted. Meaning that the ship can enter and operate in port area.

3.2.1.2 Point of Entry

Measures at Point of Entry are to control the accuracy of the pre-arrival risk assessments declarations and verify onsite the absence of risk through an inspection done by qualified personnel such as quarantine officers (Dobson et al., 2013).

Objective and Focus

Point of entry is the last preventive barrier before allowing unrestricted access to the country (MPI, 2018).

Practices

Prevention at point of entry is achieved through the deployment of biosecurity officers. According to the scope of their training and attributions the officer will verify some or all aspects of the incoming vehicle (Baumler, 2020).

In Australia, biosecurity officers will verify crew health, ballast water, garbage etc while in some other countries quarantine officers will limit verification to crew and to accommodations and port state control officers will deal with ballast water, garbage etc.

Response to identified risk

If the biosecurity officers' notices inconsistencies or unacceptable risk, he/she will deploy enforcement measures such as quarantine. Agencies responsible for quarantine, have the legal right to isolate persons they suspect to be sick. Through this measure they are separated from the general population and movement limited to prevent further transmission (Medicine et al., 2006).

3.2.1.3 Post Entry

After departure of the vehicle, biosecurity agencies will continue to monitor for any sign of spread of biohazards in order to respond rapidly in the event of an outbreak (Dobson et al., 2013).

Objectives and Focus

The intent of practices at this site is to monitor for sign of harmful organisms and pathogens for rapid response and asset protection (Westphal et al., 2008).

Practices

Measures at post-entry is centred on surveillance, incursion response and pest management, as well as contingency planning.

Surveillance

Bio surveillance is actively occurring in order to “detect new incursions or oncoming epidemics” (Dobson et al., 2013, Page 13). Bio surveillance can either be routine ‘active’ or ‘passive surveillance’.

Routine surveillance is made of programmes which are set up to target a specific species in distinct places (e.g. survey for new pest in national agriculture systems). Routine surveillance also include pathway surveillance, which monitors specific high risk sites for unspecific organisms (Dobson et al., 2013).

Passive surveillance occurs when there are no known threats. This approach would simply investigate reports of possible sighting of unwanted organisms (Dobson et al., 2013).

Biosecurity officers must also be trained to undertake surveillance for pest and diseases of concern (Australia Department of Agriculture and Water Resources, 2016). For Example, in Australia one must qualified as an Authorised Officer (AO) by having a degree in agricultural science, biological sciences, animal science or a related area. Also, attend yearly refresher courses on current harmful organisms and pathogens of interest.

Incursion Response

If a pathogen or harmful organisms are detected through monitoring, rapid response is necessary for containment and eradication to minimize the spread of the disease (Baumler, 2020).

Incursion respension is carried out by trained biosecurity officers who attempt to determine the specie and its distribution to ascertain the risk level. This will guide the

biosecurity officer on the response measures to enforce. Response can be initiated immediately to carry out eradication or gather additional information (Dobson et al., 2013).

Pest Management

In cases where species are not detected early and immediate full scale eradication is not possible, efforts are directed at pest management for containment of the core population to minimize the spread of the species into other locations (Dobson et al., 2013). This is also deployed to lessen the negative effects of the pest (Meyerson & Reaser, 2002).

Pest management would entail public education and support to be able to detect and report of any sign of pest or organism. This community support would require coordination and partnership among key stakeholders and the public (Meyerson & Reaser, 2002).

Contingency Planning

Contingency plans, also called business continuity plans, focus on the possibility of an outbreak occurring and how the company will respond (Svensson, 2004).

This is essential for ensuring that anything that occurs outside the range of normal operations does not affect the organizations ability to operate (Bloom & Menefee, 1994).

The contingency plan protects resources, minimizes operational inconveniences and identifies key staff (Svensson, 2004).

3.3 Development of Biosecurity Regulations in Shipping

Ship as Vector: Infectious Diseases

In addition to ancient evidence of isolation of persons with infectious disease (e.g. Lazaretto for travellers with Leprosy) (Deepak & Gazzoli, 2012; Ithakisios & Vozikis, 2014). Measures taken to manage biological threats from ships was essential.

Shipping demonstrated early consideration for the control of harmful pathogens via the establishment of quarantine systems. In 1377 when vessels were required to spend 30 days in mandatory isolation prior to being granted access to the Mediterranean seaport to prevent the spread of plague (Mouchtouri et al., 2010). This law was termed “trentino” but later evolved to “quarantino”, meaning forty in Italian, when the isolation time extended to 40 days (Sehdev, 2002).

The shortcomings of the quarantine system, which was costly and interfered with seaborne trade, was later supplemented with medical inspection of ships at ports (White, 1935). An example of the expansion in preventative measures was seen during the 19th century Cholera pandemic. Ships were inspected by health officers, if cholera was present passengers had to undergo a mandatory 30-day quarantine (Bilson, 1977).

The identification of pest, such as rats, as vector for diseases led to the development of more specific preventative measures (White, 1935). The International Sanitary Convention of 1944 and the work by the Port Sanitary Authorities were some of the first attempts to provide uniform measures to prevent the spread of diseases from overseas trade (Howard-Jones & Organization, 1975; Maglen, 2002).

Preventative measures formally included mandatory medical inspection of persons, inspection of ships from plague infected ports by a “rat-officer”, fumigation of ship if rat is detected, supervised discharge of cargo and the sanitary inspection of ships every 6 months to ensure ships were free of rats (White, 1935).

The International Sanitary Convention was later adopted by the WHO in 1951 as the International Sanitary Regulations (Hardiman, 2003), later amended and renamed as the International Health Regulations (IHR 2005) (Gostin & Katz, 2016).

Currently, as explained by Mouchtouri et al., (2010), the possible routes for transfer of disease was expanded from humans. As “ships may provide the place for disease transmission from person to person; they may be the source of infection (e.g. contaminated food, surfaces, water), or they may act as a means through which infections or vectors may be transmitted internationally”(Mouchtouri et al., 2010).

Ship as a Vector: Harmful Aquatic Organisms and Pathogens and Human Diseases

It is not until recently that shipping has been recognized as responsible for the unintentional transfer of organisms and harmful pathogens through ballast water and hull fouling from ships (S. C. Barry et al., 2008; Clarke et al., 2017).

The IMO had developed regulations, through the Marine Environmental Protection Committee (MEPC), for the management of ballast water and biofouling.

Ballast water is essential for safe operation of ships during its journey. Transfer occurs when ballast water is pumped into the ships tank at one location and later released at another location to maintain seaworthy conditions (GEF-UNDP-IMO, 2013). Uptake and discharge of ballast water can occur in open sea but is primarily carried out in ports (GEF-

UNDP-IMO, 2013).The ballast water released can contain an array of marine species (IMO, 2018a).

Biofouling is described as the “accumulation of microorganisms, plants, algae and animals on submerged structures”(IMO, 2019). As ships travel from one region to the next these organisms can detach from the ship’s hull and become invasive species.

COVID-19 and Ships

When cases of COVID-19 multiplied, the Director-General of the World Health Organization (WHO) declared the outbreak of Coronavirus as a Public Health Emergency of International Concern (PHEIC) as per the IHR (2005). The outbreak was declared a pandemic on 11th March 2020 as it spread to all continents (WHO, 2020).

Current information released from the WHO indicates the disease can be spread from person to person when respiratory droplets are projected from coughing, sneezing and talking. This is then breathed in by another person or a land on surface that is being touched frequently. Also, an asymptomatic person can transmit the virus (WHO, 2020).

As a result of the long incubation period and the possibility of transmission from asymptomatic persons, confined spaces such as ships contributed largely to the spread of coronavirus disease (Mizumoto & Chowell, 2020; Pham & Luengo-Oroz, 2020).

Notably, passenger ships, such as cruise ships and ferries, are catalyst for infectious disease spread due to the large number of persons in close proximity (Hill, 2019).

A study by Oham and Luengo-Oroz (2020), provided three scenarios identifying shipping as one possible pathway by which the Coronavirus had spread. The first was the spread of

the disease from Wuhan, China to Japan because of the high frequency of ships commuting between the 34 ports in this area. Second, was the spread of the virus from the Canary Islands by ships that travelled to ports in 56 different countries. Third scenario was on the Diamond Princess cruise ship, where 621 persons were infected and possibly transferring the disease to persons at the various port stops (Pham & Luengo-Oroz, 2020).

3.4 International Regulation guiding Biosecurity Practices in Shipping for Human Health

WHO International Health Regulation (IHR 2005), as amended

Objective

The IHR (2005) is a legally binding international agreement that is applicable to all 192 United Nations member states. It was designed with the intent “to prevent, protect against, control and provide a public health response to the international spread of disease in ways that commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade” (article 2 of part 1).

Application

This agreement applies to all diseases that poses significant harm to humans, it aids the international community in improving public health capacities to manage these diseases and promote collaboration with WHO and other countries (Bakanidze et al., 2010).

The IHR (2005) agreement is the formal framework for the pro-active surveillance system by the WHO and the response to diseases that have the potential to cross borders (Kimball, 2016). This is the core international standard for regulating public health issues on ships.

Key Elements

Within the IHR 2005 regulations, two key elements are embedded for the sanitary control of ships. The Ship Sanitation Certificate (SSC) and Maritime Declaration of Health (Baumler, 2020).

Ship Sanitation Certificate

Operators of ships on international voyages must carry a Ship Sanitation Certificate (SSC) (article 39, IHR 2005). This can either be a Sanitation Control Exemption Certificate (SSCEC) or a Ship Sanitation Control Certificate (SSCC) (Mouchtouri et al., 2018).

According to the WHO Handbook for Inspection of Ships and Issuance of Ship Certificates (2011), the SSC “is designed to identify, assess and record any public health risks, and the consequent control measures that should be taken, while ships are in port” (page 21).

The SSC is renewed twice a year through an inspection by a competent authority or designated inspector. The inspection is used to examine numerous areas on the ship (such as living quarters, stores, engine room, potable water, cargo holds etc), to determine if a public health risk exist (WHO, 2011a).

The SSC is issued by the competent authority when control measures were required and satisfactorily put in place to ensure the ship is free from contamination and infection (Mouchtouri et al., 2018).

Maritime Declaration of Health (MDH)

Before ships arrival at its first port of call in the state territory, the master will determine the state of health on board and complete a MDH (López-Gigosos et al., 2017).

Free Pratique

At pre-entry, operators of ships are required to submit health documents (i.e SSC and MHD) as requested at the port of call. The health documents would allow the port authority to determine if any potential public health risk exist on board and to take immediate action to the reduce the risk of transmission (López-Gigosos et al., 2017).

After ship has been declared free from of contagion, port authorities would grant “*free pratique*”. As per article 28 of the IHR(2005) regulation states “ships or aircraft shall not be refused *free pratique* by States Parties for public health reasons; in particular they shall not be prevented from embarking or disembarking, discharging or loading cargo or stores, or taking on fuel, water, food and supplies.”

Facilitation of International Maritime Traffic (FAL) Convention

Furthermore, the IMO FAL convention was developed to simplify and minimize data requirements, formalities and procedures associated with the arrival, stay and departure of ships at ports.

The FAL Convention's main objectives are to ‘prevent unnecessary delays in maritime traffic, to aid co-operation between Governments, and to secure the highest practicable degree of uniformity in formalities and other procedures. In particular, the Convention

reduces the number of declarations which can be required by public authorities' (IMO, 2017).

Pertaining to health documents, ships are required to complete nine forms: the General Declaration, Cargo Declaration, Ship's Stores Declaration, Crew's Effects Declaration, Crew List, Passenger List, Dangerous Goods Declaration, postal convention document and the MDH (López-Gigosos et al., 2017)

WHO Coordination of Activities with other Intergovernmental Organizations

To manage the risk of infectious diseases from international shipping, the WHO also coordinates activities with bodies such as the IMO and ILO⁸ as outlined in article 14 of the IHR 2005 regulations.

In the event of a Public Health Emergency of International Concern (PHEIC) (article 6 of Part II), these organizations collaborate and formulate task forces which provide guidance to respond to such incidents. For example, during the Ebola outbreak IMO had joined WHO on the International ad hoc Ebola Travel and Transport Task Force (IMO, 2014).

3.5 Development of Biosecurity Practices for COVID-19 in Shipping

In the context of COVID-19, IMO and other organizations have developed industry specific guidance for operating during the pandemic.

⁸ See **appendix 4** for ILO and IMO regulations applicable to human health

This section has highlighted some of the authoritative documents prepared for managing the spread of COVID-19 at ports. For ease of organization and review, the documents have been presented by focus i.e. shore personnel, seafarers, ship etc.

Shore personnel

Several circulars have been produced with guidance on protection of shore personnel from COVID-19 risk on ships. This includes but is not limited to IMO Circular Letter No.4204/Add.6 and IMO Circular Letter No.4204/Add.16.

Some elements recommended in the circular letters are as follows:

IMO Circular Letter No.4204/Add.6

- Use of electronic solutions during all ship/shore interface to reduce from exchange of documents and interaction (page 2, para 7),
- ensuring customs, border control and port health authorities have the necessary resources to safely carry out duties in light of new protocols for COVID-19 (page 2, para 8),
- Setting in place measures for the protection of pilots (page 3, para 9).

IMO Circular Letter No.4204/Add.16

- This circular detailed an additional list of steps to be taken when shore personnel are on board to limit transmission of COVID-19.

Further, ICS had partnered with IAPH to produce guideline for ensuing safe shipboard interface between ship and shore personnel. Also, China Ports and Harbours Association has developed and published a guidance on the prevention and control for Ports and its Front-line Staff (WPSP, 2020).

Seafarers

Several circular letters have also been published with measures directed to seafarers (sea staff). This includes but is not limited to operational considerations for managing COVID-19 outbreaks on board ships (IMO Circular Letter No.4204/Add.3), protection of health and safety of seafarers (IMO Circular Letter No.4204/Add.4/Rev.1) and measures for facilitation of maritime trade (IMO Circular Letter No.4204/Add.6).

An example of measures recommended from IMO Circular Letter No.4204/Add.6 are as follows:

- Monitoring of shipboard personnel for any symptoms of COVID-19 (page 3, para 2),
- Restricting sea staff on board during port operations (page 3 para 3).
- Access to medical treatment ashore be provided to seafarers (page 3, para 8) (mandatory provision under the ILO MLC, 2006).

Further, it is also recommended for flag states to provide adequate health and safety measures for seafarers. This should include “the provision of alcohol-based hand rub and personal protection equipment. Also, the adoption of the necessary precautionary measures to prevent transmission of the virus during the interaction with people boarding ships for operational, inspection and other purposes “(IMO Circular Letter No.4204/Add.15, page 1, para. 2) (mandatory provision under MLC, 2006).

Guidelines have also been released to facilitate the process of crew change during the current pandemic. This includes but is not limited to measures and procedures for facilitating safe ship crew changes (Circular letter No.4204/Add.14/23), IMO 12-step

framework for crew changes (Coynes, 2020a) and the Port Authority of Singapore Guidebook on Crew Change (WPSP, 2020).

Ports

For measures specifically implemented in ports, guidance documents have been produced by the International Association of Ports and Harbours (IAPH) and UNCTAD.

The IAPH through its World Ports Sustainability Program (WPSP), has produced a guidance document “to prepare and alleviate coronavirus-related contingencies for port authorities and port operators” (WPSP, 2020). Similarly, UNCTAD have also produced a technical note on port responsiveness to the COVID-19 pandemic. This includes measure to implement and observe, an example of a crisis protocol and a compilation of documents from numerous ports (WPSP, 2020).

WHO COVID-19 Recommendations

On 30th January 2020, when the WHO declared COVID-19 as a PHEIC, the director General shared the “WHO COVID-19 Recommendations”. One recommendation stated that “all countries be prepared for containment of the outbreak, including early detection, isolation and case management and prevention of onward spread” (IMO Circular Letter No.4204).

3.6 Conclusion of Chapter

The COVID-19 pandemic along with previous 21st century emerging infectious disease, such as Ebola and SARS, have highlighted that diseases are still being spread globally by ships.

Therefore, as the link between transport and the spread of disease became evident. Regulations to manage this unwanted transfer of harmful organisms and pathogens began to develop and formalize. The latest is the WHO IHR (2005).

Further, in the event of a PHEIC, the WHO would also develop specific guidance in collaboration with other IGOs such as IMO and ILO.

It would be interesting to examine how ports from different countries have implemented the existing regulations with the specific guidance to manage COVID-19.

This may further justify the use of the biosecurity strategical approach as a uniform framework for organizing practices to effectively manage biosecurity risks from ships.

CHAPTER FOUR

ADOPTION OF BIOSECURITY STRATEGICAL APPROACH FOR MEASURES IMPLEMENTED IN PORTS

4.0 Introduction to Chapter

Ships have been proven as a hot spot for the spread of infectious disease including COVID-19 (Mizumoto & Chowell, 2020; Pham & Luengo-Oroz, 2020).

To prevent the spread of disease by ships the IHR (2005) has established two core regulations applying to ships and verified in ports. This includes the SSC and Maritime declaration of Health.

Therefore, in the context of COVID-19 it is expected that these instruments will be efficiently implemented and eventually complemented with other instruments.

In the context of the current crisis the WHO and other organizations such as IMO and ILO, as per article 14 of the IHR (2005), cooperate to determine good practices to control the spread. In this respect there is specific guidelines that have been developed, which should be implemented inside ports and on ships.

National Response in Ports

In compliance with the IHR (2005) and supplementary recommendations, countries have implemented restrictions and quarantine measures. These measures have drastically impacted other key components such as seafarers (e.g. limiting or completely banning

sign in/sign off) and shipowners/ ship management companies (e.g. delaying ships which can lead to cargo deterioration).

Therefore, it is important to examine what is being done in ports. The purpose of the survey was to assess the implementation of international requirements and recommendations in ports.

4.1 COVID-19 in ports- Pre-entry, Point of Entry and Post Entry Strategy

4.1.1 Introduction

To examine how port authorities from different countries have applied the IHR (2005) and guidance documents, a structured survey was used to collect data on the measures implemented⁹.

The biosecurity strategical approach (pre-entry, point of entry and post entry in ports) presented in **chapter 3** was used to develop the survey and ensure that no important aspects of implementation of health measures are omitted.

4.1.2 Structured Survey

The structured survey was administered to each respondent individually in an interactive session by the researcher. The questions of the survey were decided in advance, with the aim of presenting the same questions in the same order to each respondent. This was done to solicit responses within similar themes in an orderly fashion (Kelley et al., 2003).

⁹ As disclosed in **Chapter 1** and **Appendix 1**.

Participant Demographics

The respondents to the survey were students of the WMU S20¹⁰ class, namely from the MSEA and PM specializations. This target population was chosen as it enabled the researcher to overcome the challenges of COVID-19 for obtaining primary data from busy port authorities.

In addition, the students of WMU represented countries from all over the world, so this allowed for diversity in port authorities sampled. The respondents represented countries from Latin America, Western Asia, East Asia, South East Asia, South Asia, North and West Africa.

The participants ranged in ages from 27 to 46 and had extensive time working in the maritime field from 6 to 20 years. The professions represented included seafarers, nautical surveyors, flag state inspectors, Port State Control officers and Coast Guard officers. Each having access to port authorities and work experience in maritime administrations.

4.1.3 Data Presentation

For ease of analysis and presentation¹¹, each survey was imported into the ATLAS.ti software as a case and chronologically numbered from 1 to 31. Similarly, the questions have been numbered from 1 to 30 and coded as source (**SQ**). The different sections and parts are coded as General (**GEN**), Pre-Entry (**PRE**), Point of Entry (**POE**) and Post Entry (**POST**).

As seen in the example below in **figure 4**, Section II Part B Question 12 “Which agencies are responsible to carry out pre-arrival risk assessments?” is coded as PRE-SQ12.

¹⁰ World Maritime University 2020 student cohort.

¹¹ See **appendix 1** for more details on data analysis of surveys.

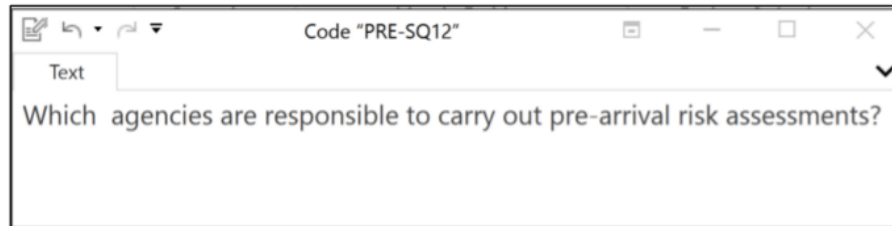


Figure 4 Code extract from ATLAS.TI for PRE-SQ12 (Source: Author)

Therefore, to answer the research question:

- What are the biosecurity measures implemented in ports to protect against the risk of COVID-19 at pre-entry, point of entry and post-entry?

Responses from the 31 participants were explored using the group code function of the software to identify similarities, differences, and unique measures at each biosecurity site.

The raw data was exported into excel sheet available in three appendixes¹²:

- Appendix 6: Pre-Entry Measures
- Appendix 7: Point of Entry Measures
- Appendix 8: Post-Entry Measures

The appendixes present a consolidated selection of all responses. To achieve this, filtering of the responses was done taking into consideration four categories:

- Region (e.g. all responses from countries within South East Asia was compiled into one),
- Completeness of survey (e.g. survey with unanswered questions was removed),

¹² The tables of **appendix 6 to 8** present the raw data gathered from the structured surveys. The assessment of the data provided by respondents has been conducted as described in **appendix 1**.

- Quality, and detail of information (e. g researcher was seeking responses specific to COVID-19, survey with only generic answers was removed).

For ease of discussion findings will be presented in a similar manner.

4.1.4 Summary of Measures implemented in Ports for COVID-19

The following section presents a summary of the results of the structured survey. Key measures implemented at pre-entry, point of entry and post entry at ports have been highlighted as reported by the participants.

4.1.4.1 Pre-Arrival Measures in Ports

Reminder:

Practices at pre-entry are focused on acquiring information before ships arrival at ports to carry out risk assessments and apply the necessary regulatory standards (Dobson et al., 2013).

Pre-arrival Documents

Firstly, all port authorities had requested the classical documents under the IHR (2005) and FAL convention for ships arrival at ports. This included the Ship Sanitation Certificate, Maritime Declaration of Health, last 10 port of calls, crew list with sign on date and port of embarkation etc.

Other authorities requested more data. This included generic and COVID-19 specific information.

Generic information/documents:

1. Outbreak management plan,
2. Medicine Chest Certificate etc.

COVID-19 Specific information/documents:

1. IHR-2005 2019-nCoV Maritime Declaration of Health form,
2. Temperature chart for crew,
3. COVID-19 self-reporting form,
4. Report any suspected case of COVID-19.

requirements which only allows for port authorities to request crew list, passenger list and the maritime declaration of health in this context.

Further, the information requested were not consistent. No two countries that were surveyed requested the same documents and information. This mismatch in measures can be considered a bad practice by the industry. It poses a challenge for crew who must respond to each requirement and eventually for ship owners and ship management companies at each port of call.

Additionally, distinctions had been made as to how far in advance documents must be submitted before vessels arrival. This varied from 48 hours to 12 hours in advance.

Requesting documents in advance is a normal practice by port authorities. However, requesting documents 48 hrs in advance allows ample time for risk assessment to be done in ports with limited resources and/or large number of calls.

The submission of pre-arrival documents through online mediums (e.g. designated portals or email) was also considered a good practice by ports as well.

Pre-arrival Risk Assessment

Two different approaches have been taken for risk assessment at port: when the ship is in-route or at anchorage.

The information submitted in advance (prior to ships arrival at port) is being used to conduct in-route risk assessment. Vessel inspection was also used by a port for in-route risk assessment. This was a good practice for identifying and only targeting vessels with history of deficiencies.

For the next type of risk assessment, when the vessel is at anchorage, additional information is collected to conduct assessment. This includes information on health condition of crew prior to arrival at port and onsite temperature screening.

Outcome of Pre-arrival Risk Assessment

From the risk assessment vessels were classified based on risk level. This classification system was used for targeting ships for additional screening by some ports or selecting the choice of inspection (e. g online quarantine inspection or extensive onboard inspection).

In summary, the ports not requesting additional information and conducting risk assessments can be thought to have poor or insufficient pre-arrival measures. Meanwhile, ports that had implemented measures outside the traditional operation by requesting additional information specific to the current crisis and carrying out risk assessments had a better system in place to control COVID-19 spread.

4.1.4.2 Point of Entry Measures in Ports

Reminder: At point of entry, the focus is on inspection to verify pre-arrival information (Baumler, 2020).
However, routine inspection of ships by biosecurity agencies, along with port operations comes at a challenge during the current COVID-19 crisis.

To adapt to the challenges, countries have introduced various precautionary measures to protect shore personnel when interacting with the ship. Practices thought to be good to protect shore personnel included:

1. Mandatory 14-day quarantine for high risk vessel,
2. Limiting inspection to only high-risk vessels,
3. Health agency boarding vessel first to verify health status of passengers prior to giving access to the other inspectors and pilot,
4. Limiting the number of persons boarding vessels,
5. Arranging meetings with relevant sea staff in a sterile room,
6. Ship crew maintaining 2m distance from shore person,
7. Disinfection of ship (e. g door of the bridge, gangway, or complete ship) prior to boarding of shore personnel,
8. No paper sharing,
9. No consumption of food from ships etc.

However, like measures implemented at pre-arrival, there was no set combination of measures implemented at point of entry for protecting shore personnel. There was variability in the number of measures implemented, as some ports had implemented 4 or 5 of the good practices mentioned above while others had implemented almost all.

Personal Protective Equipment

In addition, all inspectors, pilots, and port workers were provided with and required to wear some form of PPEs. The common items mentioned were face mask, gloves, and protective glasses. This is a customary good practice when dealing with infectious disease (e.g. use of face mask during SARs outbreak).

Notably, specific PPEs were highlighted such as the use of the N-95 mask, shoe covers, hazmat suits and disposable overalls. The N-95 mask should be the choice of face mask used by all ports as this has been scientifically proven as the more suitable mask to prevent transmission of COVID-19.

Training and Awareness programs

Additional good practices include training and awareness program for COVID-19, as well as strict social distancing rules and hand washing regimes.

Ports had also reduced workforce, to 30% or minimum number of persons required for the job, to limit interaction and number of persons exposed to COVID-19.

Sea Staff and Passengers

Good practices were also implemented for sea staff when interacting with shore personnel. All port authorities had required for crew and other passengers on vessel to wear PPEs (e.g. face mask) and some ports had implemented mandatory temperature screening for all persons on vessels.

Crew Change

Not all countries allowed shore access. In special cases, shore access was only being granted for approved medical assistance. Further, even less countries were allowing sign in and sign off at ports.

This was one of the major challenges faced by crew and companies in charge of ensuring crew change. The limitation in ensuring crew relief is leading to negative effects on the health and wellbeing of seafarers. Therefore, is considered a bad practice by governments.

Suspected Case on board Vessel

If a suspected case is reported by the Master, several measures can be taken as highlighted by respondents:

1. The most common measure was to isolate person(s) on vessel, conduct health monitoring and transfer person to hospital if case worsens.
2. Person(s) will be isolated immediately, then transferred to designated hospital ashore.
3. Person(s) will be immediately moved to temporary isolation centre in ports.
4. Ships will be moved to designated quarantine station for follow up measures such as isolation of person(s) and health monitoring. In one port vessel can be quarantine up to 14 days at the quarantine site.
5. Banning of ships with suspected case by one port.

It is difficult to determine which of these measures are considered good practices as it is reliant on the resources available at the port and their ability to safely manage suspected cases.

Nevertheless, the practice of isolating person on board and treating them on the vessel can be considered a suitable measure, particularly if the port does not have additional

capacities (e.g. temporary isolation centres). Further this measure is more preferred than banning ships with suspected cases. As crew on vessel have been stigmatized from shore access, even for medical purpose, which is in violation of the MLC, 2006.

In summary, countries that implemented measures at point of entry that facilitated timely and safe ship-shore interaction can be thought to have suitable point of entry measures in place. However, countries that did not implement appropriate measures to protect shore personnel and sea staff at point of entry, had increased chances of the diseases being introduced.

4.1.4.3 Post Entry Measures in Ports

Reminder:

Post entry measures typically involve bio surveillance (either active, passive or pathway based) (Dobson et al., 2013). If a threat (e.g. symptomatic person) is detected during surveillance, measures are deployed to eradicate or contain its spread to other areas (Harvey & Mazzotti, 2014).

Bio Surveillance

When COVID-19 monitoring was occurring in ports, it was being done in two main ways. The first is the recording of all persons entering and leaving the port and conducting routine temperature screening. The second monitoring was being done through the arrangement of check points to reduce enter and exit zones to minimize human contact, conduct routine temperature screening and ensure social distancing.

Temperature screening of persons entering and exiting the port is a cost and time effective monitoring activity implemented in ports.

However, the combination or intensity of measures in place for monitoring were different from one country to the next. Possibly because of the availability of resources and how the country perceived the threat.

Notably, not all countries had monitoring activities in place. The insufficient or absence of bio surveillance measures present the risk of unnoticed spread.

Contingency Planning

If a suspected case is detected on the port several measures can be deployed such as:

1. Increasing the level of security to minimize interaction,
2. The setup of temporary isolation centres and special quarantine zones,
3. Partial or full shutdown can for disinfection and designation of berth as area for high risk vessel with established and separated entry/exit and barricading facility etc,

All contingency measures highlighted by respondents can be considered good practices.

4.1.5 Conclusion

Biosecurity practices implemented in ports varied from one region to the next as well as from country to country. Notable measures implemented at ports for each biosecurity site includes the following:

1. Pre-Entry: the use of risks assessment (i.e. in route and at anchorage).
2. Point of Entry: Precautionary measures to protect shore personnel during inspection (e. g disinfection of ship, 14 day quarantine of high risk vessel, social distancing between shore personnel and sea staff, use of PPEs etc) and the limiting or complete banning of sign in/sign off for seafarers at point of entry.

3. Post Entry: Bio surveillance (e. g temperature screening).

However, some other measures implemented were questionable (e.g. not allowing access to the shore for crew and the banning of vessel with a suspected case).

Therefore, the utilization of the pre-entry, point of entry and post-entry framework allowed the researcher to organize the biosecurity measures implemented in ports into clear zones of activities for comparison. Also, the biosecurity framework gave an idea of where international regulations and guidelines are being applied and by whom.

4.2 Gap Analysis between observed practice and IHR (2005) regulations and additional recommendations

A gap analysis was done to compare measures observed in ports with existing requirements of the IHR (2005) and authoritative documents.

Therefore, two set of gap analysis was done as follows:

- (1) Comparison of the observed practices with the requirements of the IHR (2005).
- (2) Comparison of observed practices with recommendations from authoritative documents prepared specially for COVID-19.

The gap analysis has been presented in tables divided into the axis of pre-entry, point of entry and post entry. Each table has three sections, i.e. the IHR (2005) requirement or recommended COVID-19 measure, the observed practice from survey and the researcher comments (comparing the requirement with the observed practise and estimating its level of compliance).

4.2.1 Gap analysis between observed practice and IHR (2005) core requirements

The following tables present a selection of measures observed in ports from the survey and the corresponding IHR (2005) regulations:

Pre-Entry (1)	
IHR (2005) regulation	Mandatory reporting of any suspected cases of disease to the next port of call by the master (article 28, para.4).
Survey response	Governments have requested for the Master to report all suspected cases of COVID-19 on vessel.
Comments	Reporting of suspected case of the disease is also a normal measure, like the submission of the SSC and MHD. Therefore, states had implemented this measure in a similar manner at pre-arrival, which is key for the timely detection and isolation of the case.

Table 1 Gap analysis of Pre-Entry measure and IHR (2005) requirement part 1 (Source: Author)

Pre-Entry (2)	
IHR (2005) regulation	Information collected through pre-arrival declaration such as: requiring travellers to submit information about destination (to be able to contact them) and about previous countries or locations visited (to identify if person was in or near an affected area or persons) (article 23, para. 1).
Survey response	At pre-arrival information such as crew sign on date and port of embarkation is requested.
Comments	This was a normal practice, so implementation did not vary. The requesting of crew list is also in compliance with the FAL convention.

Table 2 Gap analysis of Pre-Entry measure and IHR (2005) requirement part 2 (Source: Author)

Point of Entry	
IHR (2005) regulation	If evidence of public health risk is identified from inspections, state parties can apply additional health measures (article 23, para.2). This can include disinfection, decontamination, isolation of persons etc as detailed in article 27 and article 43. Additional health measures must be based on scientific principles and any available guidance advice from the World Health Organization (Article 43, para.2).
Survey response	Two measures have been selected as comparison to each other and the requirements: <ul style="list-style-type: none"> • Isolate person(s) on vessel, conduct health monitoring and transfer person to hospital if case worsens. • Ships will be moved to designated quarantine station for follow up measures such as isolation of person(s) and health monitoring. In one port vessel can be quarantine up to 14 days at the quarantine site.
Comments	States have implemented the regulation in various ways. Both measures focused on the isolation of the person from the other crew or passengers. However, the measures chosen may have been based on the resources available and the capacity of the port.

Table 3 Gap analysis of Point of Entry measure and IHR (2005) requirement (Source: Author)

Post Entry	
IHR (2005) regulation	To develop and maintain a system to detect, assess and notify of any public health threat (Article 5, para. 1). Annex 1 of the IHR (2005) regulation details core capacity requirements for surveillance and response.

Survey response	Bio surveillance in ports were centred around recording persons entering and leaving the ports and routine temperature screening.
Comments	Governments took similar approaches to bio surveillance. Possibly because of temperature screening being one of the main methods for determining COVID-19 symptoms, cost effectiveness and availability.

Table 4 Gap analysis of Post-Entry measure and IHR (2005) requirement (Source: Author)

4.2.2 Conclusion of GAP analysis between IHR (2005) recommendations and observed practices

Despite the regulations of the IHR (2005) being broad and interpretation largely left up to states. Some measures implemented were similar or had small variations for each country surveyed.

The measures that are in place during “normal” circumstances are the ones that have the least variation in implementation. However, the measure activated for PHEIC (such as COVID-19) has variation in its execution (e. g measures taken if suspected COVID-19 case is on vessel).

WHO Recommendations for COVID-19

It has been established that the WHO “Recommendations for COVID-19”, which are developed under the IHR (2005), should be used to guide national measures in response to PHEIC such as COVID-19.

Similar to the IHR (2005), states have interpreted and employed these measures in different forms as well. Probably as result of its broad scope and application (e.g. countries

are to control diseases outbreaks through isolation and case management (WHO, 2020). States are left with the question of “how” to effectively isolate suspected cases and manage outbreaks utilizing their available resources.

Nevertheless, some national responses have incorporated requirements of the IHR (2005) and the authoritative documents providing industry specific guidance.

4.2.3 Gap analysis between observed practices and other international recommendations

The following tables present an assortment of measures observed in ports from the survey and selection of substantial provisions extracted from different recommendations (i.e IMO Circulars¹³ and the UNCTAD Technical note¹⁴).

Pre-Entry		
IMO	Circular	Request information about health status of crew on ship in relation to COVID-19 upon ships arrival, etc.
Letter		
N0.4204/Add.4		

¹³ The recommendations have been chosen from IMO circular letters as these are developed in coordination with other IGOs and NGOs and is approved by the relevant IMO committee. These circulars are distributed to all IMO member states, UN and specialized agencies, IGOs and NGOs (in consultative status with IMO).

¹⁴ UNCTAD technical note was chosen since they serve as a permanent IGO at the UN and have vast knowledge of shipping activities across all sectors.

Survey response	At pre-arrival information is requested such as the IHR-2005 2019-nCov Maritime Declaration of Health, Temperature chart for crew and scanned copy of medical log for the last month.
Comments	Countries have implemented this recommendation by requesting three different documents. All these documents requested can to some extent be used to determine COVID-19 risk on vessel with other routine (or normal) documents.

Table 5 Gap analysis of Pre-Entry measure and Authoritative Document recommendation (Source: Author)

Point of Entry	
Circular Letter N0.4204/Add.6	Ensure those working in ports and having access to ships are provided with appropriate personal protection equipment (which could include masks, hand sanitizers and other means of preventing the spread of the virus) prior to contact with seafarers.
Survey response	Shore personnel are provided with face mask, gloves, and protective glasses. Also, more specifically the use of the N-95 mask, shoe covers, hazmat suits and disposable overalls.
Comments	The variation in measures for PPE can be because of the lack of specificness within the recommendation. As respondents have shared that PPEs were provided in different combinations for shore personnel. Persons boarding vessel were required by some countries to wear a set of PPEs such as hazmat suit, face mask and protective eyewear. Whereas, stevedore (or port workers) were required to wear only a face mask.

Table 6 Gap analysis of Point of Entry measure and Authoritative Document recommendation (Source: Author)

Post Entry

IMO Circular Letter N0.4204/Add.4	Personnel and vehicles entering and leaving the ports should be registered and checked to form a closed-loop management based on information collection. Also, one or two non-contact body temperature check points should be established at entrances.
UNCTAD Technical Note	Establish a point of control in the perimeter of the port area to monitor temperature and related symptoms (automated temperature screening) and equip it with anti-bacterial solutions and sanitizers.
Survey response	Recording persons leaving and exiting ports and conduct routine temperature screening.
Comments	Bio surveillance, as highlighted by respondents was primarily done through temperature screening at different locations (i.e. at the main gate or checkpoints throughout the port). The recommendation from both the IMO circular letter and UNCTAD technical note had the same intent but was implemented differently.

Table 7 Gap analysis of Post-Entry measure and Authoritative Document recommendation (Source: Author)

4.2.4 Conclusion of Gap Analysis between observed practice and recommendations from authoritative documents and observed practices

The measures implemented from the authoritative documents had some variations as seen in the examples of **section 4.2.3**.

The examples (responses from survey), in its limited context, highlight how governments have interpreted and executed one measure to the next. However, the variation in these

singular examples can be used to shed light on the mismatch in the overall approaches implemented at each biosecurity site.

Further, the authoritative documents developed had overlaps in some recommendations (e. g recommended measures to facilitate crew change at ports) and differences in others (e. g measures recommended in UNCTAD technical note on port responsiveness to COVID-19 compared to the guidance document prepared by the World Port Sustainability Program for port responsiveness).

Some documents were not cohesive (i.e. most were prepared individually and not connected to the next) and scattered on various websites, online shipping portals and circulars (e.g. Maritime Administration circulars). Notably, IMO was one of the organizations that prepared guidance documents in reference to the previous (i.e. through circular add on).

Entities such as the International group of P&I clubs, ship agents of the Wilhelmsen group, the Ship management and Marine Service Company V. Group and BIMCO have made efforts to develop online dashboards which provides information on guidance documents, port regulations and restrictions put in place in response to COVID-19 (WPSP, 2020).

The online dashboards have facilitated master and crew to search for their next port of call and become familiar with requirements and measures implemented at that port specifically.

Despite the development of such mediums, the various measures implemented are still considered burdensome and adaptation to each is challenging for crew.

4.3 Conclusion of Chapter

The biosecurity strategical framework was used to organize the various measures implement at ports into three spatially arranged sites: pre-entry, point of entry and post entry.

Through this organization it was possible to underscore measures taken to manage the risk of COVID-19 from shipping. Measures that can be considered “good” practices” were also highlighted in this process.

The survey shows that the measures taken varied from one nation to the next. Confirming the reports made to IMO by members states (IMO, 2020).

The measures implemented in ports have elements of both existing regulations (i.e. IHR 2005) and recently emerged guidance documents (e.g. IMO Circular Letter No. 4204/Add.15- COVID-19- Personal protective Equipment).

The differences in biosecurity approaches may be attributed to the broad scope of the IHR (2005) and its limitations in providing direction to governments for managing a pandemic of this magnitude.

Also, each country is different, i.e resources, capacity, priorities, method of interpreting regulations and guidance etc. So, the approach taken by each country was tailor made for them.

Moreover, the measures in place have not stopped the spread of the disease or minimized its impact on shipping. COVID-19 is still directly impacting the industry with outbreaks on ships and at ports. The travel restrictions and quarantine measures imposed by

governments particularly affect seafarers who are still stranded at sea and faced with challenge of sign in/sign off and vessels are still being denied access to ports. This needs to be addressed as 30,000 seafarers are still stranded at sea (Lloyds List, 2020c).

Therefore, it is more than timely for a uniform framework to be adopted which a dual purpose of protecting public health and seaborne trade. The Biosecurity Strategical Approach can be used as the framework for managing all biosecurity risk from shipping

This standardized approach would alleviate or lessen the challenges currently faced by the industry that the IHR (2005) and guidance documents are not able to achieve. The Structured Biosecurity Approach would provide a clear direction to all port authorities/governments on measures that should be implemented without hindering seaborne trade and its health and social aspects.

CHAPTER 5

CONCLUSIONS

5.0 Introduction to Chapter

The objective of the research was to investigate the impact of COVID-19 on all segments of shipping, as well as to examine biosecurity measures implemented in ports to prevent the spread of the disease.

Therefore, this chapter will provide a brief overview of COVID-19 “Shock on Everything” and highlight three major areas of challenges shared amongst the key components.

It will also provide an overview of the measures implemented in ports in relation to the IHR (2005) and authoritative documents prepared for managing the current crisis. Furthermore, the “good practices” will be summarized from the measures implemented for COVID-19.

5.1 COVID-19 “Shock on Everything” Summary

5.1.1 Introduction

To recap, in order to investigate the impact of COVID-19 on shipping a document review was done to map the effect the pandemic has had on the twelve level 1 components.

The elements in the map was compiled from documents collected over a period of 8 months. So, the map grew and evolved over time.

5.1.2 Mapping of COVID-19 impact on shipping

The global mapping was able to highlight the major components of shipping and its interconnected nature. This was done in one incredibly detailed and intricate diagram.

Furthermore, it underscored how activities or lack of activities in one component can impact another and vis versa (e.g. shut down of cruise industry impact on shipyards and the delay of vessel repairs on insurance claims).

Therefore, the operation of shipping, as evident in the mapping, can be compared to the functioning of the human body, i.e. “just as the organs in an organ system working together to accomplish their task, so the different organ systems also cooperate to keep the body running” (Marieb & Hoehn, 2007, page 13).

Impact of COVID-19 on Shipping

The Coronavirus pandemic has changed the environment shipping is currently operating in.

The outbreak of the disease itself, as well as tight internal and external border control measures implemented by the different governments has led to challenges across all sectors.

As underscored by articles in Lloyd’s list, such as the “Coronavirus is the everything Shock for the years to come” (Olser, 2020a) and “Outlook: is shipping coping with the pandemic?”(Lloyds List, 2020a). The mapping exercise has reiterated the message from these articles that COVID-19 has indeed impacted all the components of shipping.

Furthermore, the negative impact or challenges brought on by the pandemic is multifaceted. It has amplified current and introduced new challenges faced by shipping, including crew change for seafarers, shut down of the cruise industry and decarbonization.

Seafarers Mental Health and Wellbeing

Shipping is characterized for its global nature and multinational workforce, particularly seafarers.

The pandemic has shed light on the important role seafarers play in the world economy. Consequently, it has also exacerbated the challenges faced by them.

The challenge for ship owners to facilitate crew change has led to widespread extension of Seafarers Employment Agreements by flag states. This has lengthened seafarers time on board.

Working on ships has already been inherently associated with isolation, stress and social pressures. The extended time on board or not being able to sign on to work has exacerbated the issues of fatigue (physical and mental), depression, financial strain etc, which can lead to unsafe work practices, suicide, refusal to work, reduced interest in seafaring jobs in the future etc.

The International Maritime Organization “has called facilitating crew changes and getting seafarers home two of the biggest challenges facing the shipping industry from COVID-19” (Coyne, 2020, page 1, para.1).

“And all this because governments are reluctant to take measures that, by facilitating the movement of persons to and from their ships, would ensure the unimpeded flow of international trade and peoples’ well-being” (Lowry, 2020, page 2).

Cruise Industry

The cruise industry was a booming business prior to the COVID-19 pandemic. However, majority of cruise lines has suspended sailings until the end of 2020.

This may result in the biggest bankruptcy in history and companies have had to take out massive loans to pay bills in the meantime.

“The figures, as calculated by Reorg, have Carnival borrowing \$4bn backed by 86 ships; Norwegian \$675m backed by two vessels, its two private islands and intellectual property; and Royal Caribbean a total of \$3.3bn over two issuances backed by 28 vessels and intellectual property (Coyne, 2020b, page 1).

Furthermore, the layup of cruise ships has negatively impacted crew and shipyards as well. Like other sectors, crew of cruise ships were abandoned and faced with a multitude of mental and physical health issues as well as financial concerns.

Similarly, shipyards are facing the lowest orders for vessels since the 2008/09 depression and those dedicated only to cruise vessels have had a drastic slow down in operations or are closed.

Decarbonization of Shipping

Before the COVID-19 pandemic, decarbonisation was set to be one of the major goals for shipping in 2020.

Decarbonization of shipping industry is largely dependent upon state support, availability of finance and regulatory pressure. As the development and instalment of “green” equipment (e.g. scrubbers) and use of sustainable fuels is largely dependent on finance and interest of the states.

Consequently, this has been completely undermined by the current pandemic. So , “while the long-term goals remain unchanged, decarbonisation could now take a back seat while governments focus on rebuilding their economies, injecting further uncertainty into the regulatory timelines and leaving owners wary of making any firm decisions (Meade, 2020, page 2).

Nevertheless, pressure is still being applied from consumers, some states, and a changing supply chain to ensure the IMO decarbonization goal is met by 2050.

Notably, companies, such as Maersk, are still on path to meet climate targets of net zero emissions goal.

5.2 Biosecurity Measures Implemented in Ports for COVID-19

5.2.1 Introduction

A structured survey was used to collect data on the measures implemented in ports to manage the risk of COVID-19.

The measures were organized into the pre-entry, point of entry and post entry axis of the Biosecurity Strategical Framework.

5.2.2 Summary of measures implemented in ports for COVID-19

The port, as identified from the mapping exercise, is the main area for enforcement of quarantine and restriction measures for international shipping.

Some measures implemented are within the scope of the IHR (2005) (e. g SSC and MHD). Others are implemented from the authoritative documents developed for managing COVID-19 from shipping (e.g. protection of shore personnel during ship-shore interaction).

5.2.3 Good Practices identified from biosecurity measures implemented in ports

The world, along with shipping, must adjust to operating in a “new normal”, as there is a strong possibility of the pandemic being “lengthy” (WHO, 2020c), extending into 2021 (Lloyds List, 2020a).

Therefore, due to the implications of governments applying various approaches and the longevity of the current pandemic, it is essential for a uniform approach to be adopted to manage biosecurity risks from shipping. This approach can be built using the Biosecurity Strategic Approach and practices that are considered “good” from the survey responses. This can provide a starting point for developing the framework tailor made for shipping.

To answer the research question:

- How can biosecurity measures in ports be improved to strike a trade-off between protection of public health and economic development?

A list of “good practices” is summarized in **table 8** below.

Biosecurity site	Good Practices
Pre-Entry	<p data-bbox="557 478 1133 510">Information collection prior to arrival of vessel:</p> <ol data-bbox="597 527 1331 995" style="list-style-type: none"> <li data-bbox="597 527 1331 657">1. The use of established online portals for pre-arrival correspondence. This portal should detail all pre arrival requirements for managing health risk at the port. <li data-bbox="597 674 1331 995">2. Requesting of additional information, apart from the Ship Sanitation Control Certificate, the Maritime Declaration of Health and the last 10 port of call is strongly recommended. Additional information can include the scanned copy of the crew medical log, temperature chart for crew from the last 30 days, as well as specific completed forms such as IHR-2005 2019-nCoV Maritime Declaration of Health form. <p data-bbox="557 1066 769 1098">Risk Assessments</p> <ol data-bbox="597 1115 1331 1436" style="list-style-type: none"> <li data-bbox="597 1115 1331 1297">3. If the resources are available, risk assessment both in route and at anchorage should be done. Assessment at anchorage serves as a safety net for verifying information submitted and result of in route risk assessment. <li data-bbox="597 1314 1331 1436">4. Also, to decide if online inspection is suitable or if a detailed on-board inspection is required. Limiting unnecessary inspections.

<p>Point of Entry</p>	<p>Precautionary measures for shore personnel when interacting with ship</p> <p>Inspection:</p> <ol style="list-style-type: none"> 1. Due to the high person to person transmission of COVID-19 the 14-day quarantine of high-risk vessels is a good approach. 2. This mandatory quarantine can also be supplemented by having the health agency boarding first to verify health status of vessel before other inspectors and pilot can board. This minimizes the risk of transmission of COVID-19 from international vessels. <p>PPEs and Other Measures</p> <ol style="list-style-type: none"> 3. Personal Protective Equipment and other precautionary measures such as sanitizing and social distancing must be clearly defined for all shore personnel and sea staff. <p>The choice and use of PPEs must be done based on scientific research. PPE's such as N95 mask, face shield or goggles, shoe covers, and disposable overalls should be used by biosecurity agents boarding vessels.</p> <p>After use of PPEs, it must be properly disposed of according to recommendations by WHO.</p>
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	<p>Shore staff such as port workers must actively practice social distancing and frequent hand washing.</p> <p>4. Training and awareness program are essential in controlling diseases that have no vaccine. Posting signage and conducting informational sessions are key in the identification and reporting of suspected cases, as well as preventing the transmission of the disease.</p>
Post Entry	<p>Bio surveillance</p> <p>1. For bio surveillance in ports, the use of established entry points for mandatory temperature screening of all personnel entering and existing the port is a cost-effective measure for carrying out syndromic surveillance.</p> <p>Contingency Planning</p> <p>2. Contingency planning is key for preventing the spread of disease. The use of special quarantine zones and if possible, the setup of temporary isolation centres at ports is essential.</p> <p>3. The partial or full closure of ports is an effective measure for preventing transmission. This should be followed by disinfection methods based on scientific research.</p>

Table 8 "Good Practices" identified for pre entry, point of entry and post entry

5.3 Chapter Conclusion

The study had utilized two different data collection methods and analysis: Document analysis-mapping exercise and structured survey. The mapping exercise was used to investigate the impact of COVID-19 on shipping and the structured survey was used to examine biosecurity measures implemented in ports for COVID-19.

From the mapping exercise, four key findings were obtained, i.e.:

- The large number of players in the shipping industry,
- The interrelating and interdependent nature of shipping,
- COVID-19 has extensively impacted each of the components and
- The port was the main site for quarantine and restriction measures implemented for shipping.

Likewise, during the examination of the biosecurity measures implemented in ports three key findings were obtained also, i.e.:

- Key measures implemented in ports were the use of risk assessment at pre-entry, precautionary measures for protecting shore personnel when interacting with ship and limiting sign in/sign off for crew at point of entry and surveillance at post entry.
- Biosecurity measures implemented incorporated elements of the IHR (2005) and guidance documents prepared to manage COVID-19 in shipping.
- The measures in place has not minimized the impact of COVID-19 on shipping or the spread of the disease.

Therefore, a uniform framework is needed to address the mismatch in measures implemented. The Biosecurity Strategic Approach as recommended in this research can be used.

CHAPTER 6

REFERENCES

6.1 Introduction

The following list includes references used in the literature review and from the key elements presented for each component impacted of COVID-19 in section 2.3 of the mapping exercise.

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APPENDIX 1

RESEARCH METHODOLOGY

Qualitative Research

Scientific research is “conducted for the purpose of contributing towards science by the systematic collection, interpretation and evaluation of data”(Çaparlar & Dönmez, 2016).

After a literature review was done to develop background knowledge and identify the research method. The qualitative approach was chosen to answer the research questions.

In general, qualitative research is ideal for exploring and describing an event, as well as investigating the reasons for decision making (Creswell & Poth, 2016).

Contrary to quantitative research which is systematic and objective, qualitative research is emergent and flexible evolving as the study progresses (Palmer & Bolderston, 2006). This flexibility was key as the study is focused on an ongoing event, the Coronavirus pandemic.

Further, it is able to provide deep meaning and detail from the study of a small number of cases (Lune & Berg, 2017; Mahoney & Goertz, 2006).

Indeed, the qualitative research methodology chosen must be able to facilitate the transition from research question to the results (Devers & Frankel, 2000), which the case study was able to achieve.

Case Study

A case study is a systematic inquiry used to describe and analyse an individual, group or phenomenon in detail (Cronin, 2014); it examines the interplay of all variables to provide a complete understanding of an event (Rebolj, 2013).

This is the preferred strategy to answer how and why questions, particularly in cases when the researcher has no control over the event being explored (Colorado State University, 2018).

Case studies can employ a wide range of research methods to explore phenomenon (Cronin, 2014).

Therefore, to meet the following objectives of this research:

- To investigate and map the impact of COVID-19 on shipping.
- To examine the measure deployed in Ports to protect against the threat of COVID-19.
- To recognize good practices to improve ports capacity to manage biosecurity threats

Two separate data collection methods and analysis were chosen to conduct this study: document review and structured survey.

Document Review

The document review was used for the mapping exercise. It was used to collect data from existing documents (Smit, 2002).

Advantages of Method

Documents are a readily available source of information. Many documents exist in the public domain, so if a public event has occurred there will most likely be an official record of it (Bowen, 2009). In addition, obtaining and reviewing documents is very cost and time efficient (Colorado State University, 2018).

Document review, when used with other data collection methods, can support or refute, clarify or expand on findings, which can assist in removing bias (SAGE encyclopaedia, 2018).

The review of documents can provide a background and more holistic view of the data, therefore contextualizing one's research in its field (Bowen, 2009).

Data Collection

Existing and readily available public documents were used for the review from websites of important news journals and organization providing statistical reports for the maritime world.

Mapping Exercise

- The mapping exercise utilized documents from news articles published on Lloyds list, Tradewinds, Safetyatsea, Digital Ship etc as well as circulars from the various maritime administration and relevant intergovernmental organizations and NGO's such as IMO, WTO, ILO, ICS, UNCTAD, OECD etc.
- All documents that focused on COVID-19 and shipping were downloaded and compiled into a single folder.

- Documents were collected from 1st January 2020 to 15th August 2020. A total of 712 documents were identified, of this 55 was from research institutions, 94 from international organizations, 68 from maritime administration and 495 from shipping journals and news outlets.¹⁵

Data Analysis and Presentation

The data collected for both literature review and mapping exercise has been organized, stored, and processed using the ATLAS.ti program.

Literature Review

The documents were loaded onto the software and organized into categories based on the subtopics such as, biosecurity, bio surveillance, biosecurity sites, shipping, and coronavirus.

The software was used to read and search through documents for the literature review. The coding feature of the software allows for quick searches using key words or phrases (C. A. Barry, 1998).

Document Review- Mapping Exercise

The documents collected were organized into key components, i.e. Seafarers, Regulators, Technology, Classification Societies, Finance, Ship owners and Ship Management Companies, Shippers/Forwarders/Transporters/Trade, Shipyard and Ship repair, Ship breaking, Finance, Maritime Education and Training (MET), Environment and Ports.

¹⁵ See **appendix 3** for list of document sources and quantity of files obtained from each.

The categories or groupings were chosen by the researcher as an attempt to organize the interrelating entities and bodies operating within the industry. This was necessary for ease of discussion and presentation.

key words, phrases and quotations were extracted and presented by creating codes (Paulus & Lester, 2016). The network analysis tool on ATLAS.ti was used to map the codes created to demonstrate the impact of coronavirus on shipping and interrelating nature of the industry. This is one of the major strengths of this software as there are no limits on units of coding, networks can be easily manipulated and updated (C. A. Barry, 1998).

The mapping exercise was used to highlight the magnitude and severity of the impact of COVID-19 on key components in the shipping industry, as well as the areas of impact shared between and amongst the various entities.

Structured Survey

A structured survey or questionnaire is a document designed with a consistent set of questions in a fixed layout that details the exact order and wording of questions for gathering data from participants (Cheung, 2014).

Advantage of Method

The structured survey was chosen since it would help in answering research questions by eliciting answers for the same questions from all respondents. The open-ended questions in the survey provided rich insights into the questions asked and provided depth and details for the close ended questions (Matveev, 2002).

The survey was first pilot tested on three respondents of the target population. This was done to ensure the questions and instructions were clearly understood (Kelley et al., 2003).

Participants

Participants for the survey were selected using purposive sampling. This method of sampling is essential for choosing the respondents with the most insight into the research questions (Devers & Frankel, 2000). The participants were selected due to their experience of working in maritime administration and direct access to port authorities in their countries.

A total of thirty-one students from the World Maritime University (WMU) voluntarily participated in the survey. From the Maritime Safety and Environmental Administration (MSEA) 27 persons participated and from Port Management (PM) specialization 4 persons. The sample size was sufficient to fully inform of the phenomenon being studied. Additional samples collected from the source population would not have resulted in the identification of new concepts or ideas, but only lead data saturation (Sargeant, 2012). This became evident as the researcher was collecting and processing data simultaneously.

Data Collection

For the survey, each of the 31 respondents met individually with the researcher. The questions were asked in an interview format during an interactive session (Kelley et al., 2003).

As the questions were being answered the responses were typed into a word document and saved in individual files.

The use of a structured survey aided in organizing all responses in a similar format since it was arranged from general questions regarding biosecurity to more specific details about measures carried out at pre-entry, point of entry and post-entry at ports.

Data Analysis and Presentation

The results of the 31 surveys were prepared on an excel sheet for import into ATLAS.ti for processing. Each survey became an individual document, whereby all individual questions were coded to create group categories to summarize the response of each question for ease of review and interpretation.

Similarly, to the approach for the document review, the responses of the survey were examining through interrogation. This was done to seek answer to the research question by developing specific group codes (e.g a group code for risk assessment which summarized all responses to the three questions about this).

The responses of the survey were summarized into tables, which are a consolidated and representative selection of all responses. The organization of data into compressed tables for ease of presentation and discussion was done by taking several factors into consideration for ensuring the data from survey used for analysis was unbiased and thorough (Kelley et al., 2003)

Firstly, responses were grouped by **country** and further into **geographic regions**. The geographic regions were Latin America, Western Asia, East Asia, South East Asia, South Asia, North and West Africa. Secondly, the responses were then reviewed for

completeness. Any survey with unanswered questions or incomplete information was removed (e.g if the respondent did know the answer to a question and responded with “not sure”. Thirdly, survey with generic **responses** not specific to COVID-19 was removed to ensure only quality and detailed responses were used in the analysis specific to the ongoing pandemic.

This resulted to 15 consolidated responses categorized into pre-entry, point of entry and post entry.

Research Ethics

Researcher sought and received consent from the WMU Research and Ethics Committee for involvement of human participants during data collection. The project was carried out meeting the ethical standards of the university and general research ethics and code of conduct.

This was ensured by receiving consent by participants prior to participation in the interactive survey session. Each survey included a cover letter detailing the aim and objectives of the research, purpose of the study and the survey instructions. Respondents were also informed how information will be used and that they their identity will be kept anonymous.

Limitations of the study

This research will have several limitations and constraints considering the challenges of conducting research with limited time, during the current COVID-19 pandemic and the nature of research itself.

Limitations of Qualitative Research

The general limitations associated with case studies is due to its lack of scientific rigor, difficulty in generalizing findings and conclusions, as well as the challenges with data collection and analysis of large volumes of data (Bowen, 2009).

Limitations of Document Review

Issues may arise in ensuring the document used for the review was “necessarily precise, accurate, or a complete recording of events that have occurred” (Bowen, 2009, p. 33). This is exacerbated by bias that may be present in the document itself from the author and from the researcher when selecting documents (Bowen, 2009). Also, since coronavirus is a current issue, research articles published may not have been peer reviewed.

Case studies generate large volume of data (Hodkinson & Hodkinson, 2001), particularly document review (Palmer & Bolderston, 2006). It is therefore difficult to address how each of the key components in the shipping industry has been impacted by coronavirus in detail.

Limitation of Survey

The use of surveys in qualitative research has the limitation that it can only capture information that represent a single point in time and the data may evolve over time (Kelley et al., 2003).

Respondents to surveys may not answer questions completely and honestly or in other cases may want to “please” the researcher introducing bias into the study (Jansen, 2010).

Some information requested from survey may be considered sensitive information, a breach of security and related to ongoing investigations for some maritime administrations. Respondents were therefore not able to gather and share all pertinent information to complete the survey.

This was also compounded by administrative offices overwhelmed with COVID-19 response and were not able to assist in supplying all the information.

Further, the non-probability-based nature of the respondent selection means the sample may not be the most representative (Sharma, 2017).

Limitations of Qualitative analysis software

The use of computer aided software such as ATLAS.ti requires time to become acquainted with the software and it may also be challenging when choosing the right tools to analyse and present the data which does not compromise validity and reliability (John & Johnson, 2000)

APPENDIX 2

STRUCTURED SURVEY

Dissertation title: A case study on biosecurity measures implemented in ports to combat covid-19 and its impact on maritime shipping.

Overall aims and objectives of research:

1. To understand the concept of biosecurity and its relationship with maritime shipping.
2. To investigate and map the impact of COVID-19 on maritime shipping.
3. To describe and examine what measure are implemented in the ports at pre-entry, point of entry and post-entry to protect against the threat of COVID-19. This includes identification of gaps, constraints and challenges in implementation of measures.
4. To recognize best practices and lessons learnt that can be used to improve ports capacity to manage biosecurity threats.

Purpose of survey: The World Health Organization (WHO) had declared the Novel Coronavirus (2019-nCoV) as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020. Since the introduction of this disease it has had unprecedented impact on the socioeconomic conditions of numerous countries throughout out the world and on global industries, particularly maritime shipping. This industry is responsible for 90% of world trade, where the main interface for the movement of goods and persons take place at ports. Therefore, the purpose of this survey is to ascertain what are the pre-entry, point of entry and post entry measures taken at ports to protect against the threat of COVID-19, as well as to identify gaps, constraints and challenges in implementing these measures.

Survey instructions: I would like to thank you in advance for taking the time to complete this survey. Please answer all questions as accurately as possible. If you do not understand a question, answer it as well as you can and note question(s) in the space available. **In the processing and presentation of the results of this survey your identity will be kept anonymous. Your name and organization will not be disclosed.** The information requested in Section I, Ques 1 is simply needed to avoid duplication of survey. Once again, thank you.

Section I: Identification details

- 1) Name of respondent _____
- 2) Age of respondent _____
- 3) Country _____
- 4) Current occupation _____
- 5) Number of years working in the maritime sector _____

Section II: Biosecurity Measures in Ports

Biosecurity can simply be defined as the combination of risk management practices and policies to protect the life and health of humans, animals and the environment from intentional and unintentional exposure to biological threats. These measures are implemented at different biosecurity sites, namely pre-entry (pre-border), point of entry (border) and post-entry (post border).

- 6) Were you aware of the concept of biosecurity prior to SAF 103 class taught by Professor Baumler? Yes or No
- 7) Were you aware of routine “every day” biosecurity measures implemented in ports? Yes or No
- 8) Are you aware of any biosecurity legislation enacted by the Country? Yes or No
- 9) Are you aware of any biosecurity legislation adopted by the country specific to ports? Yes or No

Section II Part A: Pre-entry

Measures taken at pre-entry is done acknowledging the potential threat, anticipating and preparing for it. This generally involves assessing the threat remotely via pre-departure inspection at ports/airports and pre-arrival declaration through reporting systems, surveillance, import bans and implementation of international health standards.

- 10) What are the key pre-arrival measures in place at ports to prevent the introduction of the disease? (For example- COVID-19 self-reporting form, temperature chart from vessels, individual health form submitted electronically, Ship Sanitary certificate, Declaration of Health). Please reply in the box.

11) Are any pre-arrival risk assessments being done at this stage? Yes or No

If yes, please briefly describe.

12) Which agency or agencies are responsible to carry out pre-arrival risk assessments?

13) What are your recommendations to improve pre-entry measures?

Section II Part B: Point of Entry

Point of entry measures typically involve the visit and inspection of ships (including people, goods and accommodations) for any signs of unintentional and intentional infringements. This is the last preventative barrier and is where enforcement takes place by port authorities.

14) Which agency(ies) are conducting the necessary document clearance and inspection of vessels?

15) Is port state control still happening? Yes or No

If yes, what are the specific measures taken (e.g, PPE, team with quarantine, etc.)?

16) What are the measures in place to protect marine pilots from COVID-19? (For Example, use of PPEs)

17) What are the key measures in place when the ship is at port? (For example: hygiene stations, disinfection and sanitation equipment, temperature screening, training and education programs)

18) Which agency oversees quarantine operations on shore? (This is the agency responsible to restrict the movement of persons to prevent the spread of the disease.)

19) Are seafarers allowed to disembark for shore leave? Yes or No

20) Are seafarers allowed to sign off and sign on from your ports? Yes or No

21) What requirements or standards must be met by seafarers prior to dis-embarkment?

|

22) Are there any measures in place to protect stevedores from contracting COVID-19? Yes or No

|

If yes, please briefly describe.

23) Are additional measures in place for high risk vessels? Yes or No

|

If yes, please briefly describe.

24) What are the measures in place if there is a suspected case of COVID-19 on the vessel?

|

25) What are your recommendations to improve point of entry measures?

Section II Part C: Post Entry

Post entry measures typically involve bio-surveillance (either active, passive or pathway based). If the threat is detected during these monitoring activities additional measures are deployed to respond by identifying species type and distribution in order to effectively mitigate, eradicate and/or contain it in the case of human diseases.

26) Are there any monitoring activities occurring at the ports? Yes or No

If yes, please briefly describe.

27) Contingency planning is important at the post- entry stage to minimize the impact of a disease outbreak. It considers the potential disease problems that are likely to occur on the port and includes the action to be taken to counteract them.

What are the contingency measures in place at the port?

28) What are your recommendations to improve post- entry measures?

Section III: Overview of Biosecurity measures in ports

29) What is the overall preparedness level at the port? Low Medium High

30) Have you received any report of difficulties or challenges faced in the implementation of biosecurity measures to protect against COVID-19? For example, issues with shipping companies not willing to comply, port management not supporting measures. Yes or No

If yes, please briefly describe.

APPENDIX 3

EXTRACTS FROM MAPPING EXERCISE FOR COVID-19 IMPACT ON EACH OF THE KEY COMPONENTS

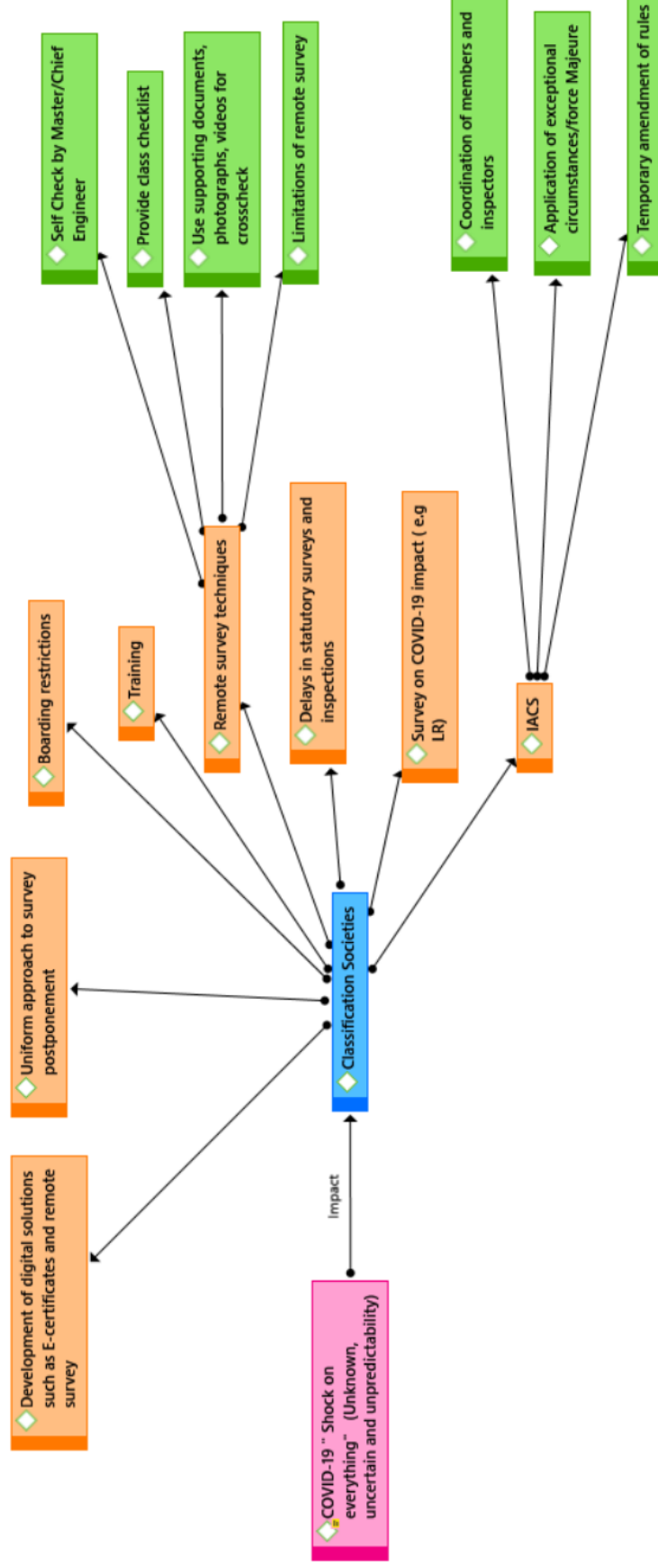


Figure 5 Impact of COVID-19 on Classification Societies (Source: Author)

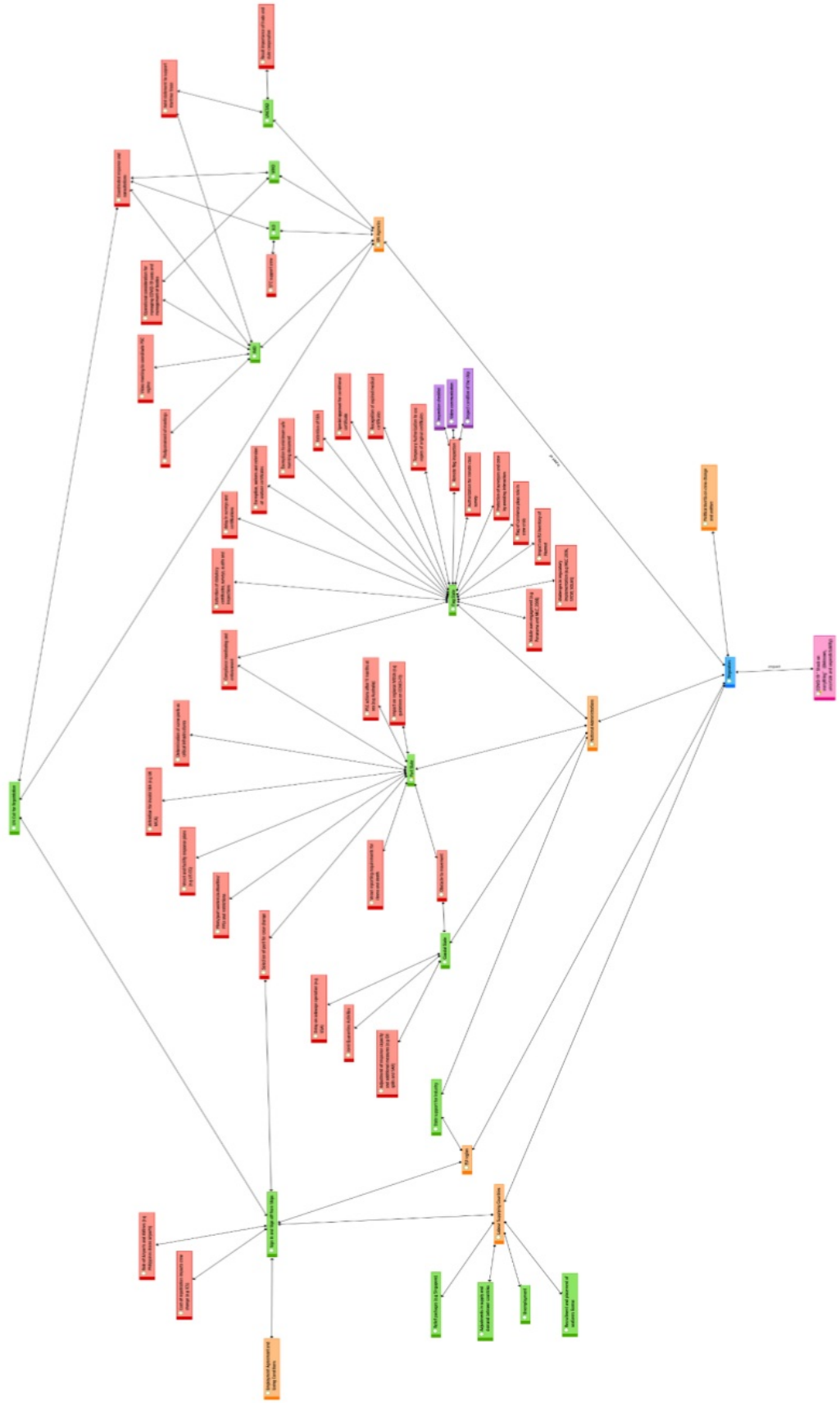


Figure 6 Impact of COVID-19 on Regulators (Source: Author)

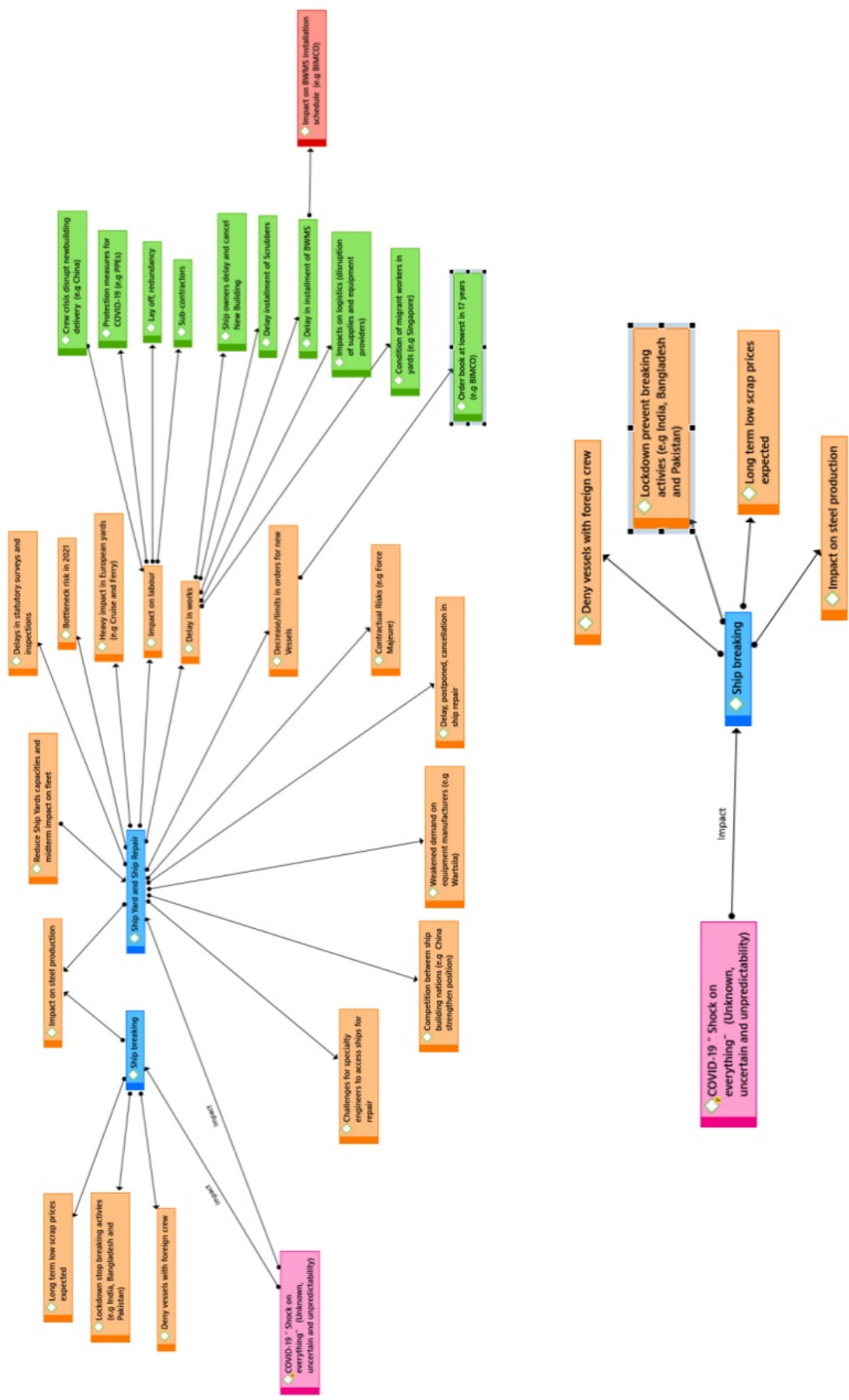


Figure 5 Impact of COVID-19 on Shipyard, Ship Repair and Ship Breaking (Source: Author)

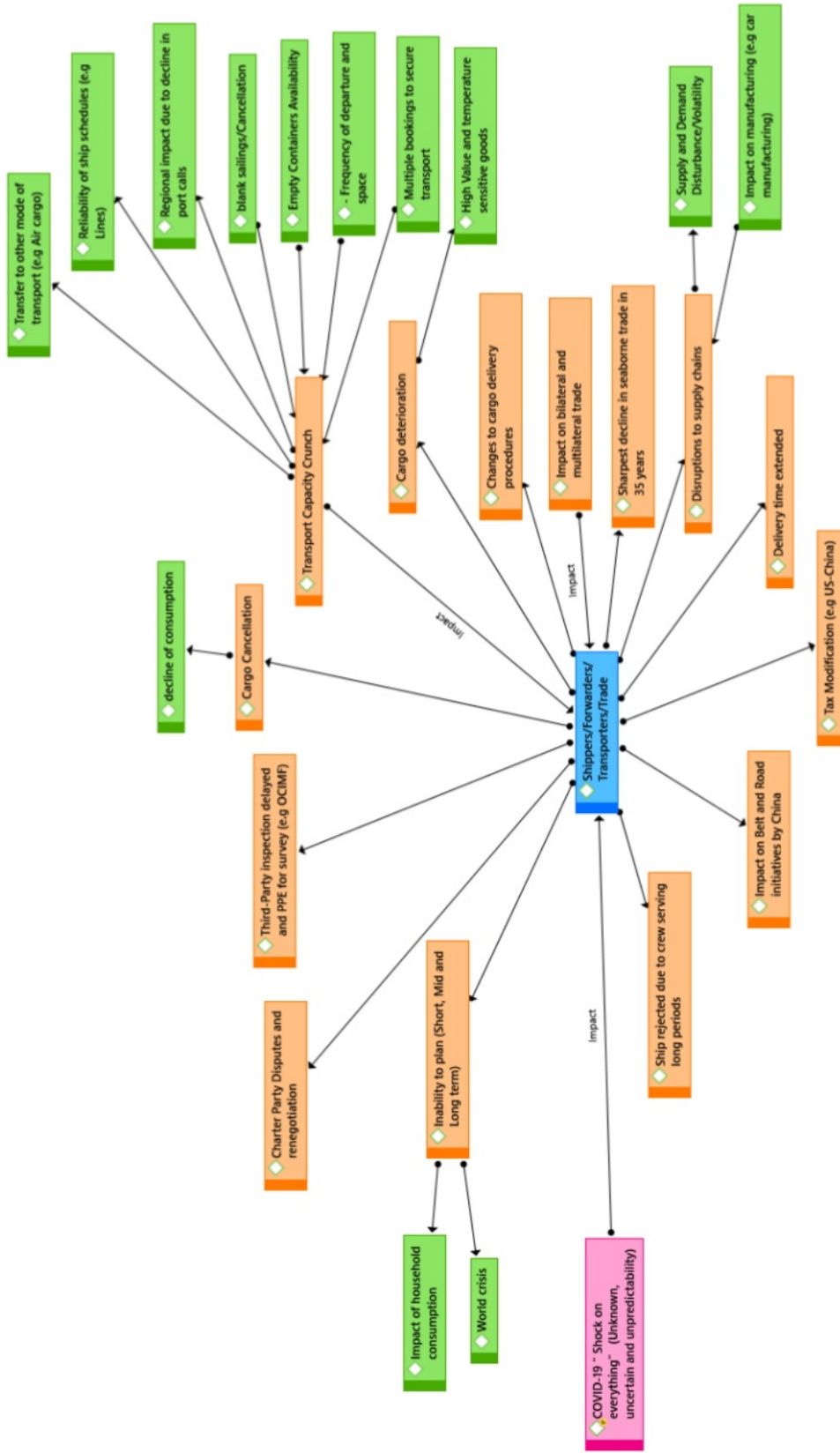


Figure 7 Impact of COVID-19 on Shippers/Forwarders/Transporters and Trade (Source: Author)

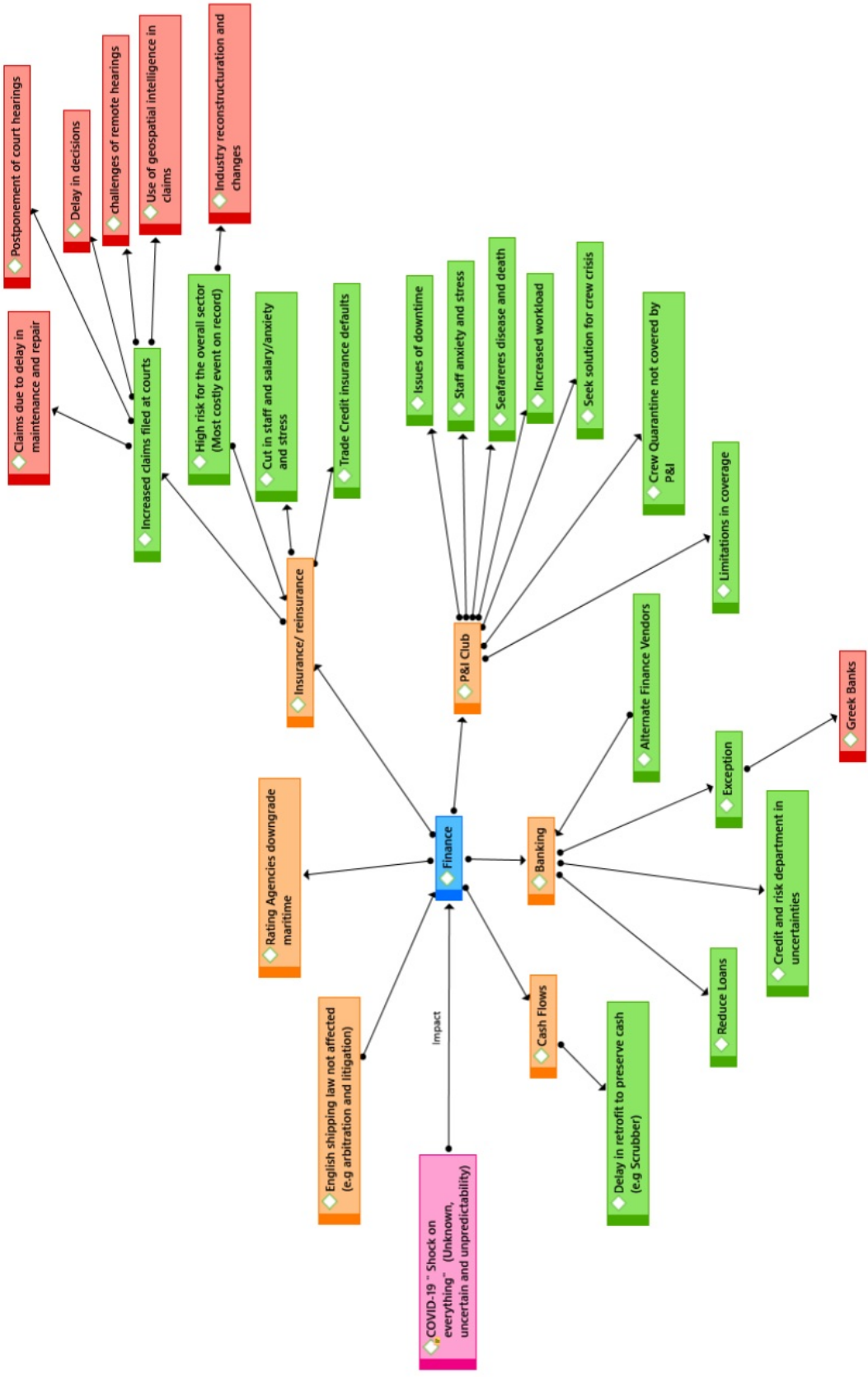


Figure 8 Impact of COVID-19 on Finance (Source: Author)

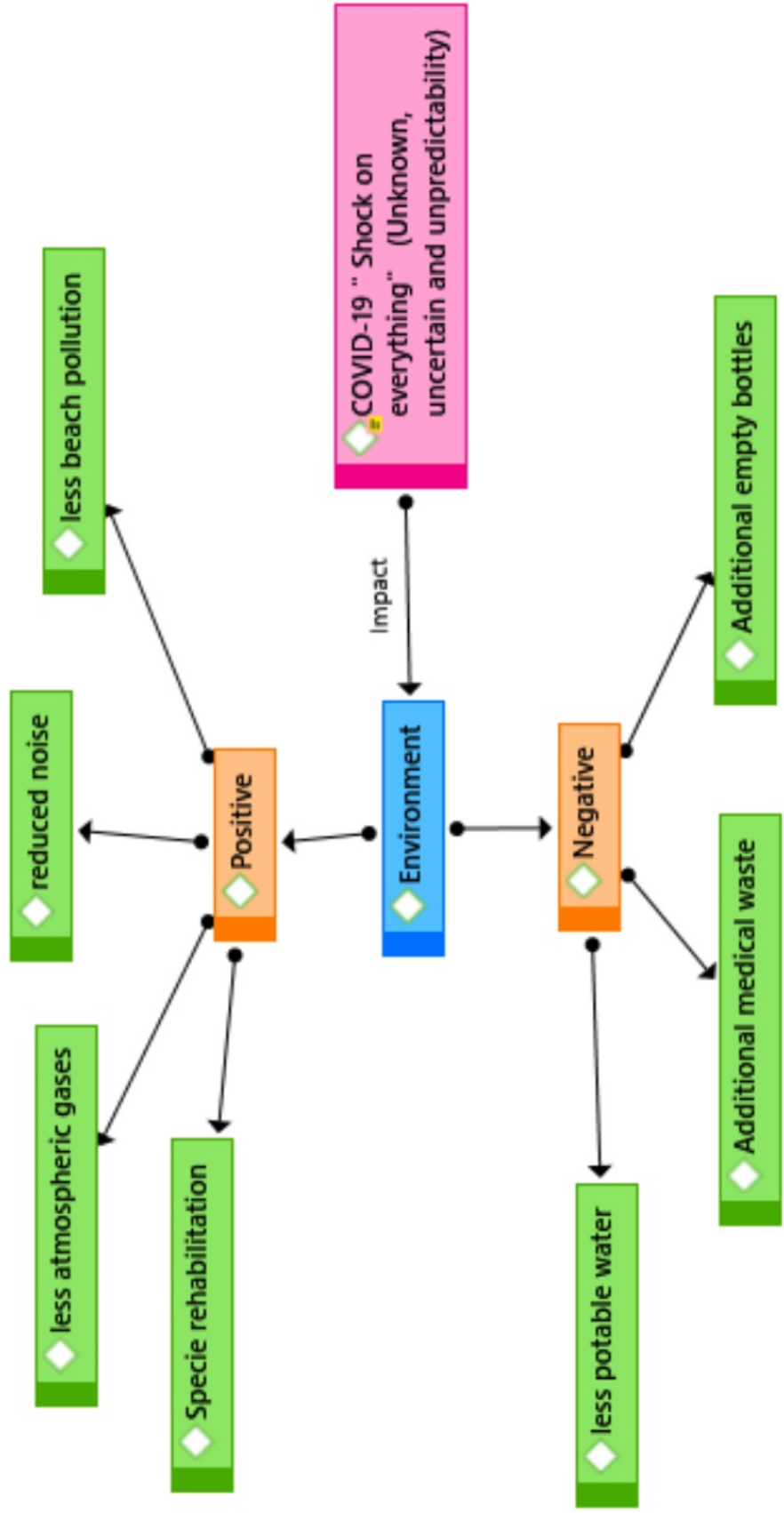


Figure 9 Impact of COVID-19 on the Environment (Source: Author)

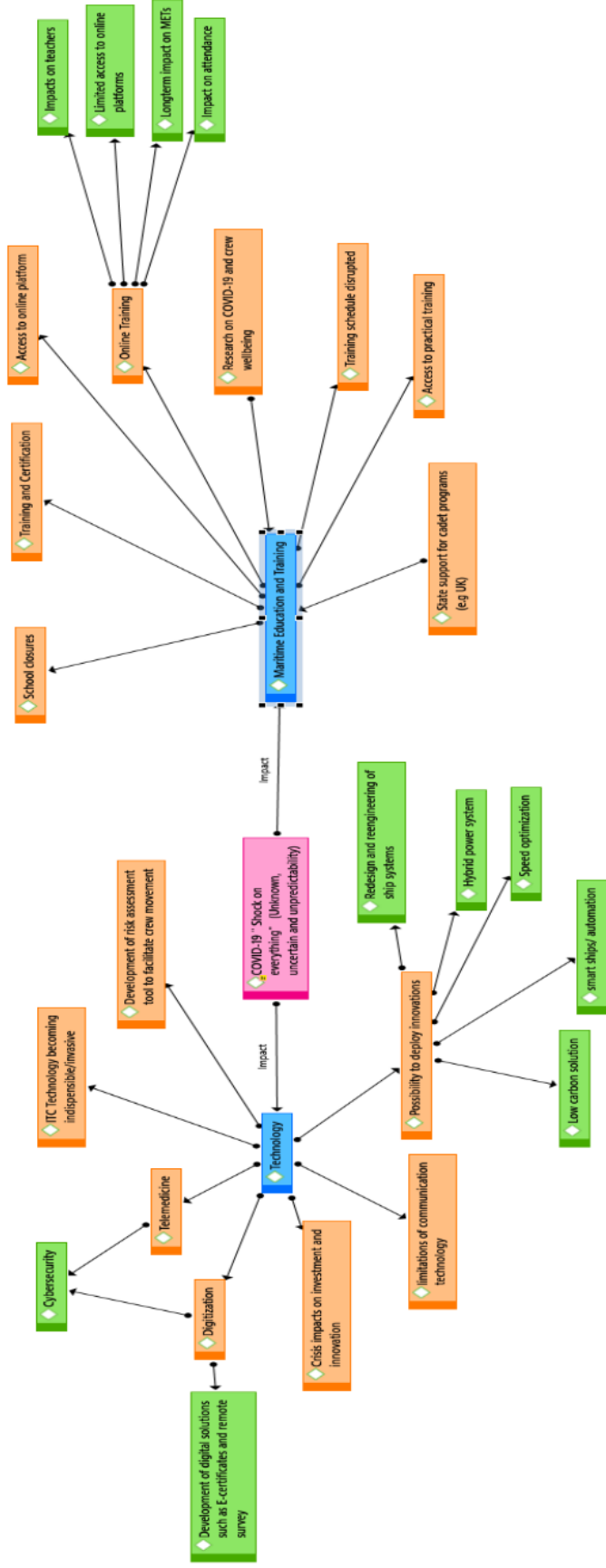


Figure 10 Impact of COVID-19 on MET and Technology (Source: Author)

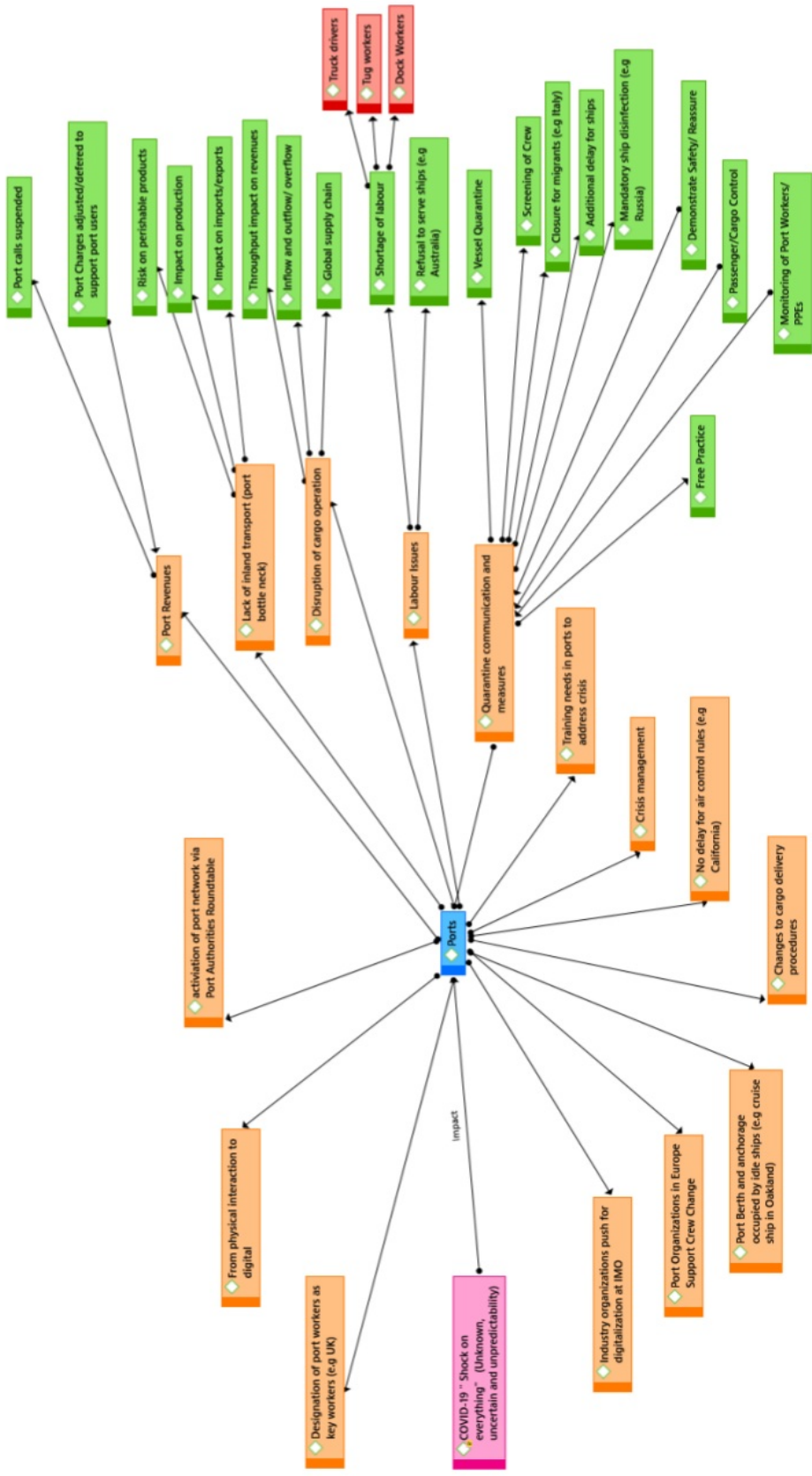


Figure 11 Impact of COVID-19 on Ports (Source: Author)

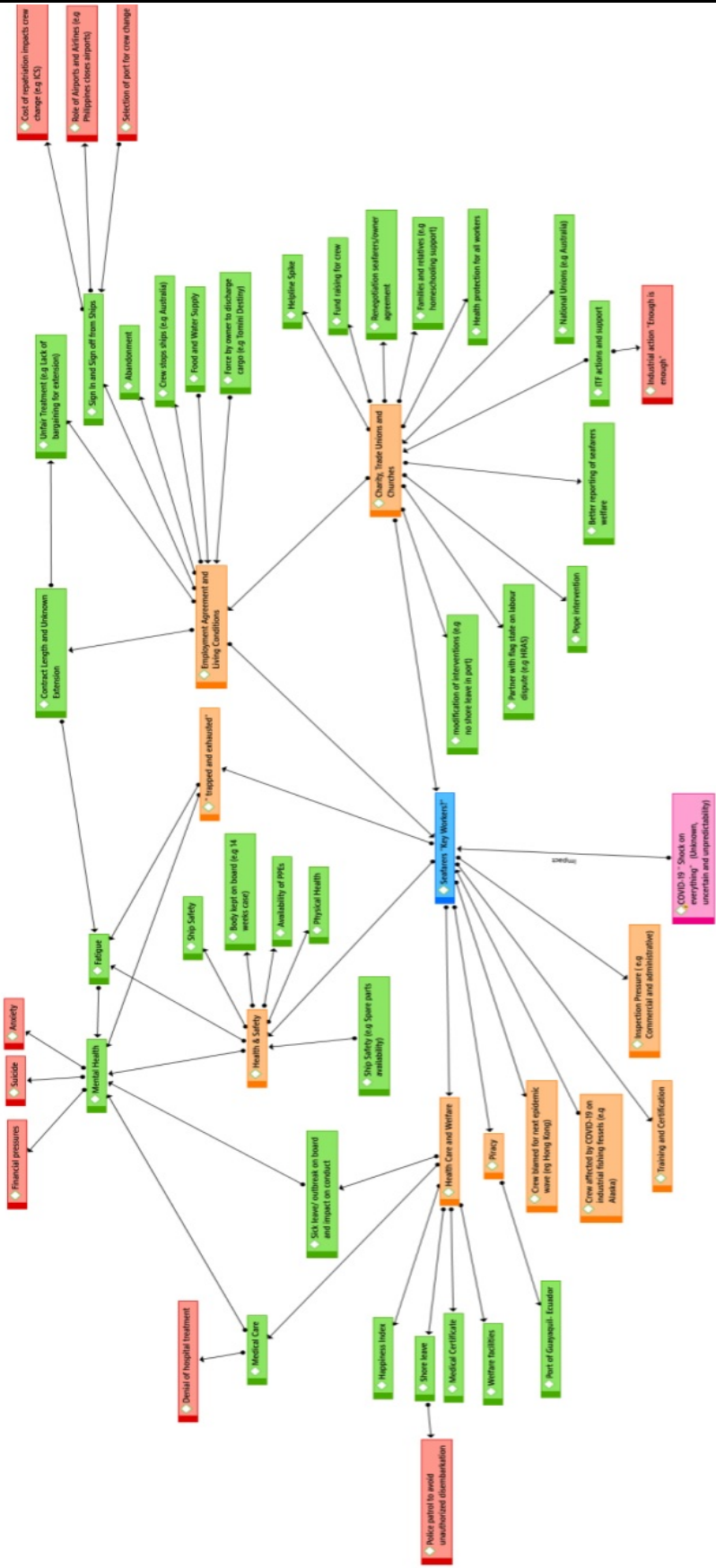


Figure 12 Impact of COVID-19 on Seafarers (Source: Author)

APPENDIX 4

IMO AND ILO INTERNATIONAL REGULATIONS FOR MANAGING RISK TO HUMAN HEALTH

The IHR (2005) is accompanied by other international agreements developed by ILO and the IMO for human health as depicted in **figure 5**.

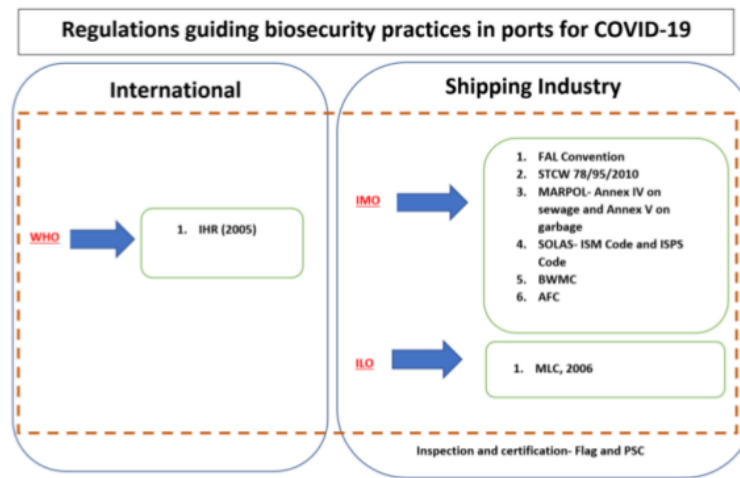


Figure 13 International and industry specific standards managing public health risks from shipping (Source: Author)

International Maritime Organization (IMO) Conventions

IMO instruments focus on safety and environmental protection. Nonetheless, these instruments have regulations applicable to the protection of human life and health.

MARPOL

The International Convention for the Prevention of Pollution from Ships (MARPOL) is one of the most detailed international treaty governing prevention of pollution from ships. This convention has 6 annexes. The annexes that regulate pollutants that have potential to directly impact human health is Annex IV (sewage) and Annex V (garbage) (IMO, 2018b).

SOLAS

The International Convention for the Safety of Life at Sea, 1974 (SOLAS) is the most important convention regulating safety of ships by setting minimum standards for the construction, equipment, and operation of ships.

The International Safety Management (ISM) code requires the identification and documentation of all potential risks to persons and ship along with their safeguards in a Safety Management System (SMS). This code is made mandatory under the SOLAS Convention (IMO, 2017).

BWMC

The Ballast Water Management Convention (BWMC) is intended to manage health risk from harmful aquatic organisms and pathogens in ballast water (Ware et al., 2016).

The convention requires a ballast water management plan to be in place to reduce the likelihood of transferring organisms beyond their natural range. This plan details the ballast water management requirements and supporting practices (IMO, 2018a)

AFC and Biofouling Guidelines

The International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001 (AFS) Convention focuses on managing the impacts from antifouling systems.

The Biofouling Guidelines addresses the transfer of aquatic species on ship's hull, which has the potential to become invasive or be vectors for diseases (IMO, 2019).

International Labour Organization (ILO) Convention MLC, 2006

The ILO focuses on seafarer's health, medical care and working conditions on board ships through the Maritime Labour Convention (MLC, 2006).

Before working on ships, the MLC, 2006 requires seafarers to be medically evaluated and issued a medical certificate to ensure they are fit for work (regulation 1.2).

During their time on board, seafarers must be provided with sanitary accommodation and recreational facilities (regulation 3.1), as well as safe food and drinking water (regulation 3.2).

If necessary, seafarers are to receive medical care on board ships and ashore (regulation 4.1).

APPENDIX 5

MARITIME PORT

For international shipping, the port has economic and social significance (Zaucha & Matczak, 2018), as well as being a key site for regulatory inspections and biosecurity practices.

Economic and Social Significance of Ports

Ports are designed to accommodate the movement of goods and persons and it allows for connectivity between maritime and terrestrial areas (Rodrigue, 2010).

Furthermore, ports are essential locations for facilitating the relationship between a country and their business partners, playing a key role in global supply chains (Montwiłł, 2014).

According to UNCTAD (2019), 11 billion tons of cargo was transported and 793.26 million TEUs of container were handled in ports worldwide in 2018.

Apart from being transportation hubs and economic drivers, ports also play a role in national defence, emergency preparedness and is a place of refuge for ships (Branch, 2012).

Biohazards in Ports

Ships not only transport persons and goods but are considered a major vector for the spread of pathogens and harmful organisms (Keller et al., 2011; Mouchtouri et al., 2010).

Ports being the interface between ship and shore, is one of the main sites for bio invasions (O'Brien et al., 2017; Sliwa et al., 2009). The degree of international trade and transport a port manages is direct related to the frequency of exposure and establishment of harmful organisms and pathogens (Bax et al., 2003; Westphal et al., 2008).

Port a Site for Inspections

The technical conventions by IMO and ILO, as highlighted in **section 3.2** has provisions for ships to be inspected at ports to verify that they meet all applicable standards. The WHO IHR (2005) regulations also has in place requirements for sanitary inspection of ships at ports (WHO, 2011a).

Inspection of foreign ships at national ports is done by Port Authorities (IMO, 2017). Port authorities are also responsible to maintain conveyances and facilities free from sources of infection at this site (Wamala et al., 2010)

Port as a Key Site for Biosecurity Practices

The updated IHR (2005) regulation has designated ports as an important point of entry for the management of health risks (WHO, 2011b).

Ports, along with airports and land borders, are locations for quarantine stations for human diseases. Quarantine stations, are not physical stations per se, but are small number of individuals enforcing measures to mitigate the risk posed by infectious diseases of public health significance originating on board (Medicine et al., 2006).

Measures in place at ports can prevent the introduction and spread of pathogens and harmful organisms from international shipping through early detection and response (WHO, 2011b).

APPENDIX 6 MEASURES IMPLEMENTED AT PRE-ENTRY

The following tables present a summary of the responses for measures implemented at Pre-Entry.

Country Code	Key Pre-Arrival Measures	Risk Assessment	
		Is it being done?	Description. By whom?
Southeast Asia 26:1	COVID-19 Self Reporting Form, Ship Sanitary Certificate and Declaration of Health.	Yes	Risk assessment is done based on the documentation submitted. Ministry of Health
South America 11:1	Targeting of ships by asking information from the last port of call and other information from the ship. Pre-arrival declaration with information about the crew and symptoms, days of travel, medical assistance or quarantine necessities.	Yes	Risk assessment is done based on the documentation submitted. Ministry of Health and Ministry of Transport
North Africa 14:1	All required pre-arrival information are communicated with ships' agents- Outbreak management plan, Ship Sanitation Certificate (SSC) (IHR Art 20 & 39), Maritime Declaration of Health (IHR, Art 37), crew list and list of the last ten ports of call are provided by Agents to Health authority, Immigration authorities and/or Harbour Master not later than 2 days before vessel's arrival. All vessel masters must answer health screening questions as part of their entry	Yes	Risk assessment is done based on the documentation submitted and the information reported by the captain to the port authority and the public health office. Port authority and public health authority
Eastern Europe 21:1	Submit routine pre-arrival documents such as declaration of health, last 10 port of calls and if any suspected cases of COVID-19 is on the vessel.	None	N/A N/A

<p>South Asia</p> <p>16:1</p>	<p>COVID-19 Self Reporting Form, Temperature chart, Individual Health form, IHR-2005 2019-nCoV Maritime Declaration of Health form with attached schedule showing the diseases details of the persons on board if any, Port of call list with departure dates, Crew List must be given with port and date of joining, Medical Log scanned copy for the last 1 month, details of any shore medical visit or Radio Medical Advice or any Medical evacuation or sign off done in last 1 month, Ship Sanitation Control / Exemption Certificate, Medicine Chest Certificate.</p>	<p>Yes</p> <p>As per the circular issued by Port Health Organisation (PHO), the vessels are to report the port calls, transits of the ship crew as well as temperature charts of the ship's crew for the past 30 days to the PHO in advance. In addition, the Port control collects further information from the ships relating to the condition of any of the crew members just prior to the arrival in the port. Vessel risk is assessed based upon the area it is coming from and where its crew has joined from (if any) in last 14 days.</p>	<p>Port Health Organization</p>
<p>Southeast Asia</p> <p>18:1</p>	<p>1 week in advance foreign vessels must report online the 10 last ports that were visited before arriving. Foreign-flagged ships agents report via online the health of all crew members and attach a statement free from severe pneumonia which is signed by the Master or Maritime Declaration of Health, at least two days before the ship arrives. Only international vessels with thermal screening facilities for passengers and crew may be allowed in ports. Must show declaration of health. Foreign flag cruise ships are prohibited to alongside.</p>	<p>Yes</p> <p>Informal risk assessment is being done processing information provided.</p>	<p>Port health Officer.</p>

East Asia 22:1	It includes information of name of ship, last port of call and departure date of it, number of crew members and passengers, existence of sick or if any dead persons and ETD to arrive in quarantine. It may be transferred to quarantine station by FAX, Electric form or other means	Yes	Quarantine judge whether the ship is safe or not by pre-arrival information.	Ministry of Health, Labour and Welfare
Western Asia 4:1	Checking the last 10 ports, especially if they are from endemic areas, asking if there are any infected or suspected cases, asking if any changes in crew members in the last month, ensure commitment to health safety equipment for all crews.	None	N/A	N/A
Southeast Asia 29:1	Health Declaration submitted electronically and ship sanitation certificate.	None	N/A	N/A
West Africa 13:1	Each shipping company must have a risk assessment submitted to agency before being granted access into ports. Only international vessels with thermal screening facilities for passengers and crew may be allowed into ports. Shipping agents/master of ship shall submit all documents related to crew regarding their travel to/from COVID-19 affected countries and other areas. All crew/passengers shall fill the self-reporting form.	None	Vessel considered high risk after analysis by the PHO with information provided at pre-arrival	N/A
Western Asia 5:1	Communication between master and operator, providing data and information. Acknowledge any cases with covid-19 on board ship and it is also required to complete electronic form (accept or reject of entry)	None	N/A	N/A

West Africa	9:1	Declaration of Health updated just before the entry in port and a list of the 10-last port of call combined with the port where the crew was embarked. Early report crew and passengers' illnesses to the captain of the Port (COPT). Inspection of vessels by the doctor of maritime border at the anchorage area and issuance of clearance for accessing the port. Ban of cruise ships	Yes	Informal risk assessments is being done. The information considered are: List of port of calls and restriction from ship coming from highly contaminated covid countries and the information obtained by visit at anchorage area by border doctors for suspected vessels.	Port Authority Health Department
East Asia	2:1	Onboard quarantine Inspection for vessels that visited ports in China, Hong Kong, Macau, Italy and Iran within 14 days, particularly vessels with symptomatic crew (37.5 deg. C and above) must be declared. Electronic quarantine Inspection for vessels visited ports in Japan and Europe.	Yes	Prior to granting entry, assessment is done taking into account the inspection history, last port of calls, and declared information.	National Quarantine Station
South Asia	19:1	Maritime Health Declaration and another two country specific forms are used in Sri Lankan Ports to prevent the introduction of COVID -19. Country Specific forms are Health Status Report of the Vessel (Signed by the Master) and Health Declaration form (To be filled and signed by individual). All these forms are required to submit withing 12 – 24 hours before arrival to OPL and they should submit electronically.	Yes	Risk assessment is based on the information contain in the said forms.	Port Health Office of Quarantine Unit
North Africa	28:1	Ships have to send 48 hours prior to their arrival, the ISPS declaration that contain the 10 last ports called by the ship. Based on that, port authority can track the ship's activity and if she called a port in a country where the virus was widely spread, they will take tougher measures on arrival of the ship	Yes	Port authorities classified ships among 3 levels, high, medium and low risk, based on that measures will be taken. This classification is founded basically by the last port of calls	Port authorities and ministry of health

Table 9 Measures Implemented at Pre-Entry to Manage risk of COVID-19 from Ships (Source: Author)

APPENDIX 7

MEASURES IMPLEMENTED AT POINT OF ENTRY

The following tables present a summary of responses for measures implemented at Point of Entry.

		Precautionary Measures for Shore Personnel when interacting with Ships			
Country Code	Agencies conducting ship inspection.	Biosecurity agencies	Enforcement agencies	Pilot	Port Workers
Southeast Asia 26:1	Port Health Dept, Port State Control, Customs and Immigration. .	Must wear PPEs- Face mask, gloves and use sanitizers.	Must wear PPEs- Face mask, gloves and use sanitizers.	Temperature check of the crews onboard. Pilot needs to use PPEs (mask, hand sanitizer etc)	Use PPEs (mask, hand sanitizer, ect.)
South America 11:1	Ministry of Health, Ministry of transport and Ministry of Défense.	Kitted with PPEs. Routine Port State Control has been stopped and is only occurring if violation identified.	Kitted with PPEs.	Marine pilots are provided with health training and are provided with PPEs.	Personal protective clothes, sanitation and disinfection stations

<p>North Africa</p>	<p>14:1</p>	<p>Only the agent is being allowed to go to the ships. All other inspection has been stopped.</p>	<p>Agent provided with PPEs.</p>	<p>Port State Control Inspection only occurring for high risk vessels. Provided with PPEs.</p>	<p>Based on the doctor report, pilot is given clearance to board. They are provided with PPEs and open the doors for air flow and social distancing. Only in the bridge will be only the captain, pilot and chief engineer.</p>	<p>Yes. Awareness and special training have been provided to port staff and stakeholders. Installed fixed hand wash stations. Only 30% work force would be allowed into ports limiting interaction and exposure.</p>
<p>Eastern Europe</p>	<p>21:1</p>	<p>Port State Control, Immigration, Customs and Health agency.</p>	<p>Personal Protective Equipment keep social distance. Temperature check for 14 days after each vessel inspection.</p>	<p>Provided with Personal Protective Equipment. Information sharing with quarantine etc.</p>	<p>Same as port state control. Gloves, mask and suits. Temperature check for 14 days after each vessel inspection.</p>	<p>Minimum interaction with ship personnel and they are provided with PPEs.</p>

<p>South Asia</p>	<p>16:1</p>	<p>Port Health Dept, Port state control, Customs and Immigration.</p>	<p>PSC inspection is done only if required, routine PSC inspections are not happening. If PSC inspection is done, then PSCO would take all safety measures in place including wearing of the required PPE.</p>	<p>Conduct duties using all the required personal protective equipment.</p>	<p>Marine pilots board vessel only after clearance by PHO. Marine pilots are provided with gloves, N-95 face mask and shoe covers. Precautions by boarding teams: maintain 6 feet distance, stay outside accommodation as far as possible, not consume any food or drink, etc. Low risk vessels: PPE to be used by boarding team is - three-layer mask and gloves. Other precautions remain the same.</p>	<p>Yes. Sanitizer stations have been put in place for stevedores, as well as the provision of PPEs such as N95 masks or surgical mask and gloves. This is supported by training programs. Thermal scanning, monitoring health of the personnel and providing required PPE. Coronavirus Alert & Awareness Programmes (workshop & training) are being periodically. Frequent demonstration of Personal Protective Equipment is also arranged.</p>
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Southeast Asia	18:1 All normal routine inspection and document clearance after port health staff visit.	Once the medical unit has issued clearance, agencies can board kitted in PPEs.	Provided with PPEs.	Pilots are only allowed to board vessels after clearance by PHO and must wear PPEs.	There is regular sensitization training for port workers on updated preventative and response plans for COVID-19. They are provided with basic PPEs such as face mask and gloves.
East Asia	22:1 Health Inspection Office, Customs Office, Immigration office and port authority.	Provided with health and safety equipment.	Provided with PPEs.	Provided with PPEs.	Yes. Personal protection equipment, keep social distance.
Western Asia	4:1 Minsitry of Health, port Authority, customs and immigration	Boarding party must wear PPE's. They also meet in a defined sterile room.	Provided with Health and Safety equipment.	Provided with Health and Safety equipment.	Stevedores are provided with safety informational during informational sessions and nd take extra precautionary to protect themselves such as sanitizing hands frequently.

Southeast Asia	29:1	Customs, immigration, Quarantine	Must be kitted with PPEs.	Must be kitted with PPEs.	<p>Reduce number of marine pilots on shift, limited interaction on vessel.</p> <p>Marine pilots have been advised to take the outside stairs to the bridge after boarding, avoid having meals and avoid accommodation area). They are provided with the necessary training and the use of PPEs is mandatory.</p>	<p>Yes. Maintain social distancing, body temperature screening, reduce number of persons on each shift, sanitize/disinfect, wash hand frequently and awareness program.</p>
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West Africa	13:1	PHO boards for inspection and monitoring. Routine inspections are still occurring.	Inspectors are provided with PPEs.	Provided with PPEs.	Pilot shall wear personal protective equipment before boarding any cleared vessel.	Yes. Sensitization of port workers and provided with PPEs. The ports are landlord. They have been provided with a guideline to assist in protecting and rotate staff/limit staff to reduce the number of persons that are exposed.
Western Asia	5:1	PHO boards for inspection and monitoring. Routine inspections are still occurring.	Only board after clearance by PHO and provided with PPEs. No more random inspections, only targeted vessels only.	Provided with protective attire.	Provided with protective attire.	Port workers must wear safety protective equipment and routinely temperature screened.

West Africa	9:1	All inspections and document clearance is occurring as per normal.	Limited port state control is occurring, only if three is clear ground of any violation. Use of PPEs such as face masks, gloves and disposable overalls.	Face mask and gloves	Pilot use mask and limit interaction crew members. Pilots provided with Hazmat suit and face mask and are also monitored by medical staff for any signs and symptoms of COVID-19.	Yes. Masks are obligatory for them. Information are provided to port workers on COVID-19.
East Asia	2:1	National Quarantine Station is responsible for the sanitary inspection on ships calling at ports.	Kitted with PPEs and trained.	Kitted with PPEs and trained	Use of PPEs such as face masks, gloves, and disposable overalls.	Isolation of the external personnel in a separate space from crew members Workers to wear mask and gloves
South Asia	19:1	Upon arrival at the jetty, the port medical officer will board the vessel, followed by the staff members of the different agencies	Provided with face mask, gloves, and hand sanitizer	Provided with face mask gloves and hand sanitizer.	Shipping agents must ensure subjected ship crew wear PPE before pilot boards vessel Pilots are required to wear PPEs.	Yes. Service providers have been informed to use the minimum number of persons required for the job. Further they are required to wear recommended PPEs.

North Africa	28:1	Port Health, Customs and HSE (port operator)	Officers are provided with PPEs such as face mask and hazmat suits.	Provided with PPEs.	Disinfection of pilot boat. Wearing of protection equipment: gloves, mask, protective glasses, and suit. Keep social distancing on board. No paper contacts. Disinfection of pilots after disembarking. Use of hand sanitizer is mandatory.	Yes. Wearing protection equipment, disinfection of work area before starting cargo operations, avoid interaction with crew member and if necessary, keep social distancing
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Table 10 Measures Implemented at Point of Entry to Manage risk of COVID-19 from Ships part 1 (Source: Author)

Verification and Precautionary Measures for Sea Staff						
Country Code	Inspection	Preventative Measures		Suspected case on vessel	Seafarers allowed to disembark?	Seafarers allowed shore leave?
		Personal Protective Equipment	Preventative Measures			
Southeast Asia 26:1	Temperature screening.	Must wear mask and gloves.	Temperature check for crew.	Temperature check and test for COVID-19. Send to temporary centre for self-quarantine.	Yes	Yes
South America 11:1	None	Ship personnel are to wear PPEs.	Quarantine for 14 days or prohibition to arrive to the port. Prohibition of crew to disembark.	If the ship has crew with COVID-19 symptoms the ship will be transferred to quarantine for a detailed inspection.	No	Yes
North Africa 14:1	Disinfection will be followed by a temperature screening of the crew members and inspection.	Gloves and face mask.	14-day incubation period at anchorage. All ship crew must maintain 2m distance from the shore person. To reduce the risk posed by interaction or document exchange, administrative and commercial interaction between the ship and port entities are limited by using electronic solutions.	Quarantine stations available.	No	No

Eastern Europe	21:1 Mandatory verification of documents submitted by high risk vessels through inspection.	Mask and Gloves.	Temperature checks on crew.	Isolate person and transport onshore so they can seek medical attention at designated hospitals	Yes	Yes
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South Asia	16:1	Thermal scanning, monitoring health of the personnel.	Surgical mask and gloves.	SOPs are in place for handling high risk vessels, an emergency team comprising the following officers is in place to take stock of the preparedness in the port to stop the spread of coronavirus. Designated Berth for high risk vessels and vessels in quarantine has been established with separate entry/exit and barricading facility.	In case anyone on board tests positive, then the vessel is dealt with procedures of MoHFW and following is done: Vessel is quarantined, and situation monitored by port health authorities. Infected person is isolated on board and condition monitored by health authorities. In case of any emergency, as per MoHFW procedures, person is taken to designated hospital i.e. port hospital in this case. In case of any death, body is handled as per MoHFW procedures. Vessel is disinfected by health authorities at periodical interval as per MoHFW guidelines	No	Yes.
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Southeast Asia	18:1	Temperature screening by the Port Health Officer on the crew at anchorage.	Must wear mask and gloves.	High risk vessels will be allowed to complete mandatory 14 days insolation before entering the port. Crew not allowed onto port.	If there is a suspected case prior to arriving at anchorage vessel will not be allowed into port. If the case has been detected the person will be quarantined and taken to hospital and all others that came in contact will be isolated and monitored.	No	No
East Asia	22:1	Health monitoring.	Must use face mask and gloves.	Quarantine at anchorage for high risk vessels.	Isolation, Restriction of activities or Health monitoring	Yes.	Yes.
Western Asia	4:1	Periodic visiting by the epidemic investigation teams from the Ministry of Health for medical examinations.	Are required to wear Health and Safety equipment.	Sterilize the ship completely by the official sterilization company. Preventing the crew from disembarking the ship and controlling the berths by cameras and port security.	If any case suspected, the ship's captain shall isolate the case immediately and inform the Aqaba health directorate.	No	No

Southeast Asia	29:1	Temperature screening and safety inspection	Must be kitted with PPEs.	Quarantine of vessel for 14 days. Disinfection of ships.	Affected crew will be given medical assistance/ quarantine if necessary	No	Yes
West Africa	13:1	The doctor does health screening of all crews includes temperature screening.	Are required to wear face mask.	Vessels from high risk areas will be allowed to complete mandatory 14 days isolation before entering port. Ships loading & unloading are cordoned/isolated especially those from high risk ports while banning alongside berthing. Beefed up security at quaysides and various entry points to port facilities while conducting port operations.	Temporary isolation centres are available at the ports. If crew/passenger or personnel shows any symptoms such person shall be quarantined, and samples checked. Appropriate measures will be taken based on the result.	Yes	Yes
Western Asia	5:1	Temperature screening	required to wear health and safety equipment.	If vessels are considered high risk a detailed inspection will be done with inspectors and specialized medical team.	Suspected case will be isolated and transported to designated hospital by the quarantine unit of the Ministry of Health.	No	No

West Africa	9:1	Anchorage area full visit with port health authority or even access denial.	Masks are obligatory.	Crew restricted to vessel. 14 days of quarantine for local fishermen entering from a different port.	The vessel is required to anchor, medical team get on board for the evacuation of the suspected and testing will be conducted, and ship will remain on quarantine.	No	No
East Asia	2:1	Temperature screening.	Use of PPEs such as face masks, gloves and disposable overalls.	High risk vessels are subject to onboard inspection without exception. Disinfection of the shore connection facility including the gangway.	In the cases where symptomatic crew is found at port, the ship must move to a quarantine site and spend two weeks for self-quarantine. Also, crew members have to daily report the body temperature using the mobile self-diagnosis application.	Yes	Yes
South Asia	19:1	Temperature screening.	Face mask and gloves.	If high risk vessel, decide to quarantine the ship along with crew at harbour or individuals at quarantine centre to be decided. Crew members of the ship will not be allowed to get off the ship to the jetty.	Immediate isolation of patient, directing to nearest designated hospital in liaison with Port Medical Officer. Trained medical staff with proper protection will handle patients as directed by the Port Health Medical Officer.	No	Yes.

North Africa	28:1	Daily temperature checks.	gloves, mask, protective glasses	medical staff get on board the ship in anchorage area and measure the temperature of the crew members. - fill out questionnaire by crew to trace their health conditions - making rapid covid-19 test - if there is a doubt a PCR test will be done	Health officer will be informed and will transport person(s) to designated hospital for treatment.	No	No
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Table 11 Measures Implemented at Point of Entry to Manage risk of COVID-19 from Ships part 2 (Source: Author)

APPENDIX 8

MEASURES IMPLEMENTED AT POST ENTRY

The following tables present a summary of responses for measures implemented at Point of Entry.

Country Code	Describe Contingency Plan	Monitoring/Bio surveillance		Preparedness Level
		Is it occurring?	Describe.	
Southeast Asia 26:1	Reporting system, isolation of subject and self quarantine of those in contact.	Yes	Checking and reporting system	High.
South America 11:1	Actualization of protection and mitigation plan, disinfection measures for port workers at the access, working remotely, disinfection and fumigation routines and actualization of emergency plans to minimize impact and mitigation and prevention of spreading.	Yes	Monitoring protocols for port workers, pilots, cargo handling personnel, etc.	Medium
North Africa 14:1		Yes	Launch of COVID-19 Special response team working day/night shifts with emergency hotline	Medium
Eastern Europe 21:1	Port area will be quarantined, and individuals tested.	Yes	Health surveillance over the personnel visiting the ship and port workers.	Medium

South Asia	16:1	1. An Emergency Team comprising the following officers is in place to take stock of the preparedness in the Port to stop the spread of Coronavirus. 2. Designated Berth for high risk vessels and vessels in Quarantine has been established (Berth no. BTB and NCB) with separate Entry/Exit and barricading facility. 3. SOP for House Quarantine has been prepared by CMO and an Isolation Ward has been kept ready in the Port Hospital.	Yes	Aarogya Setu is a government app and has been made mandatory and is being utilized for contact tracking and tracing. High risk personnel are being restricted to resume port duties unless testing is carried out.	High.
Southeast Asia	18:1	No contingency plan taken at ports only for seafarers and ship owners.	Yes	To ensure monitoring of the impact of COVID-19 after the ship leaves the port, parties involved in inspections and cargo activities such as port state control and stevedores will be monitored via routine temperature screening.	High.
East Asia	22:1	Patient: Isolation, Restriction of activities or Health monitoring and Ship: Disinfection, Discard, or Prohibit (Restrict)	Yes	Surveillance is carried out by specific institution of Ministry of Health, Labour and Welfare	Medium
Western Asia	4:1	If any suspected case found from the epidemic investigation teams, the ship's crew or port worker is isolated and the suspected cases are transferred to the nearest medical isolation area by the specialized medical isolation teams to continue treatment. Port will be locked down and testing of all persons who came in contact with person.	Yes	Routine temperature screening.	High

<p>South East Asia</p> <p>29:1</p>	<p>The level of security measures within port area will be increase and all necessary arrangement to minimize the spreading of virus will be enforced immediately.</p>	<p>Yes</p>	<p>Recorded of attendance during entry and exit, as well as temperature screening.</p>	<p>Medium</p>
<p>West Africa</p> <p>13:1</p>	<p>Temporary isolation centres in the port and intervention vessels provided in case of any outbreak.</p>	<p>Yes</p>	<p>Temperature checks at all port entry points. Temporary isolation centres in the port and intervention vessels provided in case of any outbreak. PHO stationed at PF entry points, quaysides conducting routine thermal checks on crews and other port users with NCDC officials stationed in ambulances. Developed strict guidelines by NIS/PHO for issuance of shore pass to local & international seafarers.</p>	<p>High</p>
<p>Western Asia</p> <p>5:1</p>	<p>Special quarantine zones provided. Individuals who are infected are isolated in special hospitals.</p>	<p>Yes</p>	<p>Checkpoints have been set up to conduct temperature screening of those entering the port area to reduce enter and exit that zones to reduce human contact and keep social distance Monitored by the Ministry of Health and database to monitor and track the history</p>	<p>High</p>
<p>West Africa</p> <p>9:1</p>	<p>The contingency plan was not ready so far. Only measures are report to national health system of any case which will take the lead in the quarantine and treatment process.</p>	<p>Yes</p>	<p>Port workers have to report immediately any disease or symptoms like covid 19. Mandatory reporting.</p>	<p>Medium</p>

		Partial of full shutdown of the port for disinfection can be considered in consultation with central disease control headquarters.	Yes	Fever check is carried out at the check point by Port Authority.	High
East Asia	2:1	Contingency plans in place and have been practiced. Stand by ambulance with navy medical staff will transfer patient to nearest hospital. Also, area is kept isolated until inspection. Only essential staff would have access to area.	No	N/A	High.
South Asia	19:1	Stop cargo operation - Send the ship to anchorage area - Send medical team onboard the ship to give necessary treatment - Coast guard Keep surveillance of the ship 24/7.	No	Monitoring is processed in the anchorage area, if there is any suspicious cases extra measures will be taken but the ship will not be allowed to enter the port until she get sanitary approval.	Medium
North Africa	28:1				

Table 12 Measures Implemented at Post Entry to Manage risk of COVID-19 from Ships (Source: Author)

