A PROJECT REPORT ON

THE EFFECTS OF COVID-19 ON MARITIME SUPPLY AND TRANSPORTATION IN INDIA

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SCHOOL OF MARITIME MANAGEMENT

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

CERTIFICATE

This is to certify that, this project report titled **THE IMPACT OF COVID-19 ON THE INDIAN SEA TRANSPORTATION AND MARITIME SUPPLY CHAIN** submitted to School of Maritime Management, Indian Maritime University, Cochin Campus by KEVIN TONY for the partial fulfilment of the requirements for the award of the degree of MASTER IN BUSINESS ADMINISTRATION IN PORT AND SHIPPING MANAGEMENT is a bona fide record of work carried out by him under my guidance.

DATE: March 2023

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DECLARATION

I, **KEVIN TONY** (Registration No.: 2105304007) student of School of Maritime Management, INDIAN MARITIME UNIVERSITY-COCHIN hereby declares that this project Report titled **THE IMPACT OF COVID-19 ON THE SEA TRANSPORTATION AND MARITIME SUPPLY CHAIN** submitted in partial fulfilment of the Requirement for the degree of **MASTER IN BUSINESS ADMINISTRATION IN PORT AND SHIPPING MANAGEMENT** is my original work carried under the guidance Of **AMRITHA CS** Faculty of School of Maritime Management .It has not formed the basis for the award of any degree/diploma or Associate ship of any University/Institution. The information submitted is true and original to the Best of my knowledge.

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ABSTRACT

IMPACT OF COVID-19 ON THE INDIAN SEA TRANSPORTATION AND MARITIME SUPPLY CHAIN

More and more organizations and researchers throughout the world are looking at the effects of COVID-19 on maritime transportation and the corresponding policy actions. The purpose of this study is to investigate the effects of COVID-19 on marine supply chains, seaport transportation, and related concerns in India. The performance metrics of important seaports in India before and during the COVID-19 crisis are examined using secondary data. We go into more detail and analyze the expert's opinions regarding the effect, readiness, response, and recovery factors for India's maritime-related industry. The quantitative performance of the major seaports in India during COVID-19 shows a decline in vessel traffic and a negative growth in cargo traffic when compared to pre-COVID-19. The results of the expert poll point to a lack of readiness for COVID-19 and the requirement for marine organizations to create future strategies. The study’s overall conclusions will help formulate maritime policies by improving supply chain resilience and sustainable company recovery while preparing for a crisis following COVID-19. The paper also points out that the Covid-19 situation is still a matter of worry as the government, marine groups, and stakeholders work to treat afflicted persons and provide vaccines. To further quantify the influence of COVID-19, this study might be broadened to include the commercial context of the global maritime supply chain as well as interdisciplinary research in maritime technical disciplines.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The globe is currently experiencing a critical phase of the newly emerging Severe Acute Respiratory Syndrome Coronavirus (SARS) virus, which the World Health Organization has dubbed the "2019 Novel Coronavirus" (Sohrabi et al., 2020; Harapan et al., 2020). The virus quickly spread from China to several countries and territories after the initial encounter. The COVID-19 pandemic is referred to as a quarantine scenario by the World Health Organization (WHO) and is recognized as a public health emergency that primarily affects human activities and economic development (Uddin et al., 2020; North, 2020). The COVID-19 pandemic originated in Wuhan, China, and has since spread to numerous countries and regions. As of April 12th, 2023, there are 660,746,894 infected individuals globally, and 6,692,538 people have died as a result (Worldometers, 2022). As of June 30th , 2022, there are 1,95,57,457 sick individuals in India, 2,15,542 linked fatalities, and 15,68,16,031 individuals who have received COVID-19 vaccinations (myGOV, 2022). Additionally, there has been a sharp increase in the number of new COVID-19 double mutant cases, which is causing a second wave of coronavirus outbreaks. Though it may take an additional two or more years, India has started a large immunization campaign with a goal of vaccinating 300 million people by July 2021.

The COVID-19 outbreak has had an impact on the maritime industry, which accounts for 90% of global trade. About 60% of all cargo traffic in India is handled by the country's major seaports. This study analyses COVID-19's effects on important Indian ports by spotting trends in quantitative performance data from both before and after the COVID-19 crisis. The effect, readiness, response, and recovery factors for the maritime-related sector in India are explored and discussed in this paper by experts. Quantitative performance data for India's major seaports show a decline in growth from the pre-COVID-19 period to COVID-19. The results of the expert poll point to a detrimental impact of COVID-19, and marine organizations must adopt new tactics. In order to prepare for a post-COVID-19 disaster in the Indian maritime context, the study's overall findings help formulate maritime strategies by strengthening supply chain resilience and sustainable business recovery processes.

1.2 PROBLEM INDENTIFICATION

Maritime-related sectors have a critical role in both the global economy and societal progress. The maritime and shipping business is one of the activities that has been severely disrupted by the spread of COVID-19. Since COVID-19 spread, many countries have closed their seaports and prohibited the majority of their export and import activities. Numerous countries have implemented severe lockdowns and social segregation policies along with an immediate reduction in production and consumption. Countries have partially

or entirely closed their borders in try to stop the COVID-19 from spreading, which has slowed the flow of people, capital, and goods and disrupted global supply lines. Following these actions, the majority of countries have already begun to feel the macroeconomic effects of this pandemic. Due to this outbreak, there has also been a nearly 60% decrease in global demand and supply as well as a 41% decrease in global exports (Richard Baldwin and Beatrice Weder di Mauro, 2020). The COVID-19 pandemic is the greatest worldwide threat since World War II, not only because of the health disaster it has caused but also because it has caused many people to lose their employment and money (UNDP, 2020; World Bank, 2020).

1.3 RESEARCH OBJECTIVE

Seaports serve as nodes and facilitators for trade and commerce in every nation, facilitating global marine connection (Kuo, 2020). The global marine sector, which accounts for 90% of global trade and supply of cargo, including food, fuel, and medicines, has been impacted by the COVID-19 outbreak (Ship-Technology, 2020; ORF, 2020). More and more researchers and organizations throughout the world are studying the effects of COVID-19 on the maritime transport domain and the related actions that have been implemented (Zhang and Hayashi,). To far, no quantitative research or expert opinion studies in maritime-related fields have been conducted in India to evaluate the COVID-19 crisis' effects on seaport transportation and the maritime supply chain industry.

- To evaluate and assess the effects of COVID-19 on the number of vessel calls, cargo volume, and segment-wise cargo volume information for major seaports in India is one of the goals of the current research presented in this paper.
- To look into how India's marine supply chain and seaport traffic are affected by COVID-19 in terms of effects, preparedness, response, and recovery.
- To put up policy recommendations by investigating how COVID-19 affects the maritime environment in India.

1.4 SCOPE OF THE STUDY

This study focuses on the impact of covid-19 on the Indian sea transportation and maritime supply chain. The situation presents a significant task for seaport transportation and marine decision-makers, but it also presents a chance to learn from the developments, contribute to containing numerous pandemic waves, and get ready for a post-COVID-19 world. The current COVID-19 situation presents an opportunity to overhaul India's maritime environment, which has been dependent on antiquated procedures. Building a worldwide commerce and investment structure capable of coping with upcoming pandemics requires the development of intelligent and flexible maritime supply chains. To ascertain the effect of COVID-19 on the marine supply chain and seaport transportation, the work described in this study can be expanded to international seaports.

1.5 DATA COLLECTION

Secondary Data

- Ministry of Ports, Shipping and Waterways official website.
- Books, magazines and newspaper.
- Various publications of the central, state and local government.
- Technical and trade journals.
- Official government websites.

Data collected from the above secondary source were used to learn about the impact of covid-19 on the Indian sea transportation and maritime supply chain.

1.6 TOOLS FOR DATA PRESENTATION

The tools used for the research are diagrams, bar graphs line graphs, combined graphs and tables.

1.7 LIMITATIONS OF THE STUDY

The limitations of the research are as follows:

- Limited time span of the project.
- Sources for collecting data were very limited.
- The research is limited to the availability of data which was not provided from higher officials.
- Some of the data are also not available due to security reasons.

1.8 DISSERTION STRUCTURE

This paper is divided into five sections. Section 2 reviews the literature on the effects of the Covid-19 pandemic on international seaports and the maritime supply chain using secondary data sources. Section three compares the financial years 2020 (during the COVID-19 crisis) to 2019 (prior to the COVID-19 crisis) using quantitative data (vessel count, traffic volume tonnage, and segment-wise cargo details) based on secondary data sources to examine and analyze the effects of COVID-19 for the major seaports in India. In the fourth section, expert survey responses to questions about impacts, preparedness, reaction, and recovery are reviewed along with further recommendations and in-depth analysis. The conclusions and executive summary of this comprehensive study, which was conducted to develop marine policy and assess the effects of COVID-19 in the Indian maritime context, are explained in Section 5. The conclusions, this study's limitations, and a summary of future research objectives are covered in section six.

CHAPTER 2

LITERATURE REVIEW

The majority of the literature on coronavirus studies focuses on how COVID-19 affects people's health and behavior. The COVID-19 epidemic's effects on the environment and transportation have received the majority of attention. To the best of the authors' knowledge, there hasn't been much research done on coronavirus's implications on supply chains and maritime transportation. The literature's analyses of marine transportation focus mostly on cruise ships, ports, and shipping operations. Since the COVID-19 outbreak began to develop, there has been a significant decrease in the volume of maritime freight movement in order to successfully stop the epidemic. The COVID-19 pandemic has significantly changed how people behave in the sea, with seaport restrictions and changes in utilization prototypes having an impact on many maritime domains, particularly the fisheries, passenger ferries, and cruise vessels sectors, which heavily rely on the movement of people and goods. *Business Impact Of Covid-19 Pandemic On Global Maritime Industry(2021)* researched how the outbreak affected shipping freight by sea and provided information on the exposure sites of different vessel types. This study found that the main shift in container shipping operations was a sharp decline in the number of ships calling at seaports. *The Cruise Industry and Covid-19 Outbreak (2020)* tracked all cruise vessels throughout the world using automated identification system (AIS) data from January 2020 to March 2020 to investigate whether or not cruise ship movement affects the spread

of coronavirus. According to this study, the countries that continued to welcome cruise ships until March 2020 experienced a greater rate of COVID-19 infection than other nations. This study also examined how the size of the vessel and the timing of port operations affect the infection ratio. According to this study, large cruise ships have a higher risk of infection on board, and most of the infected passengers or crew members on these ships travelled within a week from their home port to their port of call. Through research, individual behaviors in COVID-19 scenarios have been examined, while also considering issues of community health and wellbeing. This analysis found that the post-COVID-19 period's mobility and financial situation call for a redesign of the transportation policy. On November 27, 2020, *the Maritime Safety Agency (EMSA)* released a report outlining the effects of the coronavirus on shipping-related issues by looking at a variety of factors, including seaports, cruise ships, seaport calls both in the European Union and in countries in the far east, vessel-related movements, and also congestion at port anchorage. This analysis found that the COVID-19 outbreak has had an impact on the maritime industry both directly and indirectly. Through this analysis, it was discovered that there had been a sharp reduction in cruise and cargo traffic, particularly between Europe and Asia (EMSA, 2020).

The Economic Impact of COVID-19 Pandemic (2020) looked into the financial slowdown brought on by the COVID-19 pandemic in the oil, tourism, aviation, economic, and healthcare sectors. It found that the epidemic had spread

quickly around the world and had adverse effects on these industries' business volume, interest rates, market instability, and demand & supply ratio aspects. Through a research study, *Effects of Covid-19 on Maritime Sector(2020)* has examined the progress, developments, new difficulties, and potential outcomes for four important maritime-related industries. This study emphasizes the comprehension of four important marine industry segments, including dry bulk, tankers, container cargo, and cruises, with organized practical insights and a succinct summary of current concerns of maritime-related operations & management.

The *UNCATD Review of Marine Transport Study 2020* claims that the short-term outlook for the maritime industry is dismal. If global fiscal production rebounds, UNCTAD anticipates that global marine business development will revert to an upbeat outlook and grow by 4.8% in 2021. This report emphasizes the urgent need to invest in risk management, the international interdependence of nations, and crisis response preparedness in the area of the maritime domain. It also signals the need for the maritime transport industry to brace for transformation and be well prepared for a transformed post-COVID-19 world. On the other hand, the Covid-19 pandemic has also brought attention to the importance of maritime digitalization by raising the risk of cyberattack in maritime supply chains and logistics services in international trade.

The World Port Sustainability Program (WPSP) and the International Association of Ports and Harbors (IAPH) have been conducting seaport studies on the impact of COVID-19 to track advancements and the current state of affairs in international seaports. Through a seaport economic effect barometer that provided a thorough international and regional examination of the impact of COVID-19 on seaports, these changes were compared to preceding weeks starting from the 15th week of 2020 through the 6th week of 2021. (WPSP, 2021). A total of 70 valid responses from seaports around the world have been collected through this survey.

The *WPSP-IAPH COVID-19 taskforce* reviewed and reported on the dashboard data every week for ports all over the world based on the responses to four important survey questions that included vessel, modal, freight, and seaport workers. The following is how the study's four major questions are resolved:

I. The COVID-19 crisis's effects on vessel calls This data shows that the number of other cargo vessel calls at different seaports has been stable, and containerized cargo and other cargo vessels are at, if not above, the typical levels for this time of the year. Despite some slight improvements from previous week's tests, cruise ships continue to be the ones most severely impacted by the COVID-19 virus. Several seaports have seen an upsurge in ship movement as a result of the current scenario.

II. Impact of the crisis on hinterland transport: According to the report, the recovery of many countries' economies has led to an increase in inland transport volumes in international seaports. The research also states that there is a sharp increase in volume on many large commercial routes, which is testing the capacity of seaports and inland transportation networks. The link of some seaports' hinterland transportation must be disrupted as a result. The study states that with the flow of trucks, railways, and barges up to 100% rate, the situation has not been impacted in the least compared to typical. As a result of actions authorized to counteract the so-called "second wave of COVID-19," which is expected to have a detrimental effect on the forthcoming period, more seaports are worried about the patterns that are expected to emerge in the future.

III. Influence on capacity-related activities: According to the report, warehousing and distribution operations in seaports have decreased as a result of the sharp reduction in demand for customized goods or the closure of trading units with underutilized dry bulk storage space. The analysis recommends even more significant adjustments to the degree of tank storage for liquid freight usage. The usage of warehousing and distribution services for food products and medical supplies is also noted in the report as rising.

IV. Effect on the accessibility of port-related employment: According to the data, there has been relatively little change in the number of workers in the seaport regions. Physical interactions in the port area are being replaced by more online meetings and webinars. The report also notes that terminal operations are entirely unaffected, seaport staff activity has returned to normal, and boats are arriving, departing, and completing loading/discharge operations as usual. All activities and labor were resumed in various ports while taking into mind the required safety precautions.

CHAPTER 3

INDUSTRY PROFILE

3.1 PORTS

A port is a location with one or more harbors along the coast or shoreline where ships can dock and unload or load people or cargo. A port is a type of marine business facility that may have one or more wharves where ships can dock to pick up and drop off passengers and cargo. A port is essentially a location where goods are exchanged from one mode of transportation to another.

Locations for ports are chosen to maximize economic demand, wind and wave protection, and access to land and navigable water. Harbors can be man-made or natural. Dredging is required to regularly maintain breakwaters, sea walls, or jetties that were established as part of an artificial harbor, whether they were purposefully designed or not. On the other hand, a natural harbor has land characteristics on three sides. Because most trade occurs there, ports are the economic backbone of any country. Seaports continue to be a crucial link for getting to the global commercial center. Over the next few decades, it is projected that the amount of freight transported by sea would significantly increase.

Ports, particularly international seaports, serve as exchange facilitators for the global economy. With the skillful and astute development of goods, people, and data, they are important tools of trade policy in the domestic economy

and speak to an important interface between nations. Throughout the beginning of time, ports have served as essential nodes in the global trade network. These are also places where different societies interact and the influence of goods, information, and people is lifted or established. International trade and investment flows have also opened doors for domestic political agents, accustomed to operating within lax rules of conduct, to pursue leases and rework customer wants.

The port industry, which is a part of the marine industry, has seen significant transformation as global trade has advanced. Sensational decreases in transportation costs, which are a driving force behind global economic growth, have greatly aided global financial development. The port industry began to respond to the challenges of adjusting big boats as shipping gained experience with vessel structure and larger tonnage.

Understanding the components of or participants in the port community is crucial when evaluating the impact of policy on port organization and development. An appreciation of the many players within the port community will be aided by such a study. Ports are made up of a number of subgroups that collectively make up the port community. Ports serve as crucial nodes in the ever-more complex and sophisticated logistical networks that power the transport of goods around the world.

More jobs will be created as a result of improved port infrastructure, which will also ease traffic, cut down on pollution, and bring prosperity. The trading process is driven by supply and demand and the regulatory environment. The trading process requires the backing of trends in governance, economics, and demography. In addition to providing an overview of ports as a global enterprise, this chapter also provides some insights into the Indian port sector and maritime trade. In an era of economic globalization, ports are swiftly moving from their traditional role as suppliers of full coordinating systems to land/ocean interfaces. This suggests that due to unusual natural changes and trends in the transportation, port, and coordinating industries, ports have had to deal with a number of challenges. Ports all over the world have been working to improve their physical infrastructure, particularly container terminals and related facilities, and to expand their port hinterland by offering facilitated free trade zones with the goal of creating center ports and global coordination centers in order to adapt to the challenges and escalating issues.

3.2 HISTORY OF PORT

Ancient civilizations that conducted maritime trade frequently built sea ports. Aside from harbor structures, old anchors have also been discovered. Many of these historic locations don't exist today or serve as ports. Ports can stop being used, even in more recent eras. Modern ports are typically multimodal distribution hubs with transport connections via sea, river, canal, road, rail,

and air routes. Early ports tended to be simple harbors. Profitable ports are positioned to provide the best route to a bustling hinterland.

A port will make it simple for ships to navigate and will provide protection from the wind and waves. Ports are frequently located on estuaries where the water may be shallow and frequent dredging may be necessary. Although they are less frequent, deep water ports like Milford Haven can accommodate larger ships with a deeper draught, including super tankers, post-Panamax vessels, and huge container ships. It is advantageous for other enterprises, such as regional distribution centers, warehouses and freight forwarders, canneries and other processing facilities, to be situated at or close to a port.

3.3 PORTS IN INDIA

Port act as a nexus for the interchange of two modes of transportation—maritime and land, whether by rail or road—ports are vital economic and service-providing enterprises. As a result, ports' multimodality is their most significant characteristic. India's coast and sea islands have 205 recognized non-major ports, with a total length of 7517 kilometers, compared to 12 major ports. Gujarat has become the top marine State among the States in terms of port traffic, accounting for 40.5% of all the cargo handled at Indian ports. Also, it is claimed that 67% of the cargo carried by minor ports is bound towards Gujarat. Gujarat is followed in terms of total port traffic by Maharashtra, Andhra Pradesh, Odisha, and Tamil Nadu, with their respective

shares of 13.1%, 13.1%, 11.2%, and 9.5% in terms of all seaborne traffic in India.

All of India's major ports handled 446.50 million tones (MT) of cargo traffic between April and October 2022. All of India's major ports handled 720.29 million tones (MT) of cargo in FY22. India's exports of goods was US$ 417.8 billion in FY22, an increase of 40% from the previous year.

PORTS IN INDIA

Major ports -12 ***Non – Major Ports -205***

Fig 3.1

3.3.1 Major ports

Eastern coast of Indian

India's eastern coastal plains are located between the Eastern Ghats and the Bay of Bengal. It includes West Bengal, Orissa, Andhra Pradesh, and Tamil Nadu. The three coasts that make up the area are Coromandel Coast, Andhra Coast, and Utkal Coast. The Eastern Coastal Plains are home to the following important Indian ports:

- Kolkata Port
- Paradip Port
- Visakhapatnam Port
- Kamara jar port
- Chennai Port
- Tuticorin Port

Western Coast Of Indian

Gujarat in the north and Kerala in the south are separated by the Western Indian coastal plains, which also pass through Maharashtra, Karnataka, and Goa. It is situated between the Western Ghats and the Arabian Sea. The Kachchh and Kathiawar coast, the Konkan coast, the Kanara coast, and the Malabar coast are the four coasts that make up this region. The following are some of India's significant ports along its western coast:

- Kandla Port
- Jawaharlal Nehru port

- Mumbai Port
- Mormugao Port
- New Mangalore Port
- Cochin Port

3.4 TRADE

Global economic integration is mostly to blame for the expanding significance of international trade. Trade was common in the past, but it was constrained by the technological resources that could support it. Trading over long distances is still slow and expensive, which limits its scope and scale. By the turn of the twentieth century, transportation methods like the steamship were widespread and effective enough to support a sophisticated system of international trade. Particularly the steamship made it possible to achieve economies of scale that were previously not possible. It took until the middle of the 20th century for the global regulatory framework to open up enough to permit a more expansive kind of globalization.

Global trade cannot exist without adequate transportation, making it a critical trade facilitator. International trade is, by definition, the movement of almost all goods by sea. A sizable portion of total trade costs is made up of transportation costs, which include freight and time costs. These trade costs encompass expenditures such as policy barriers, information costs, legal and regulatory costs, as well as other costs incurred in delivering commodities to

final consumers in addition to the marginal cost of manufacturing the items themselves. Since it has been established that a 10% decrease in transportation costs is associated with a 20% rise in international trade in emerging economies, lower trade costs support trade growth.

Since 95% of all trade volumes pass via Indian ports, growing trade has had a significant impact on cargo flow. Increased trade is translating into increased demand for containerization because of its effectiveness. In June 2022, volumes handled at important ports in the nation increased month over month by 8%, even after clearing delayed consignments received from China. In November 2022, the Jawaharlal Nehru Port Trust (JNPT) had a 9.04 percent increase in total container volume. Compared to November 2021, when it handled 5.22 million tones of containers, November 2022 saw 5.70 million tones handled.

High GDP growth has led to a rise in energy demand. Almost 84 percent of the nation's overall crude oil requirement was imported in 2021. 247 million metric tones of crude oil and petroleum products were imported into India in FY21, a 5% CAGR. In FY22, there were 217 million metric tones of crude imports. Private ports have excelled in attracting crude import traffic.

3.4.1 Major elements for India’s export growth (FY 2021 -22):

India has reached its ambitious target of exporting goods worth $400 billion for the first time. Export growth is being fueled by both unmet demand during

the COVID-19 pandemic's major waves and the expansionary monetary policy implemented by developed nations to deal with the epidemic's effects.

Petroleum products (152.1%), cotton yarn, fabrics, made-ups, handloom products, etc. (55.1%), man-made yarn, fabrics, made-ups, handloom products, etc. (46.9%), engineering goods (45.5%), jute products (36.2%), leather and leather products (32.2%), ready-made clothing of all textiles (29.9%), and handicrafts, with the exception of hand-made carpets (22%) are the other top industries. Other goods that have experienced an increase in export demand include marine products, mica, coal, and various ores and minerals, including processed minerals.

After the United Arab Emirates (66.9%), Bangladesh (64.5%), the Netherlands (90.5%), Singapore (26.8%), Hong Kong (7.8%), the United Kingdom (28%), Belgium (90.4%), and Germany (21.1%), exports to the United States climbed by 46.4 percent year over year (YoY) during FY 2021–22.

3.4.2 Major elements for India’s Import (FY 2021 -22):

India now has a significant trade deficit of 87.5 percent as a result of its imports of goods exceeding its export goals. Strong price increases in commodities including crude oil, coal, gold, electronics, and chemicals helped to considerably contribute to the rising import bill as the economy reopened and business and consumption activities steadied. Increasing prices for

commodities like coal and crude oil have had a substantial impact on India's import valuation.

China was India's largest import provider for FY 2021–2022, followed by the United Arab Emirates, the United States, Saudi Arabia, Iraq, and Switzerland. In FY 2021–22, Germany, South Korea, Singapore, Hong Kong, and Singapore all made major contributions to India's imports.

CHAPTER 4

DATA ANALYSIS

4.1 IMPACT OF COVID-19 ON MAJOR SEAPORTS OF INDIA

India's 7,517 kilometers of coastline is home to 205 small and 12 major seaports (Sagarmala, 2022). Approximately 60% of the nation's total cargo flow is handled by the major ports. India's seaports processed about $829 billion worth of cargo in 2018, ranking 13th in the world for cargo volume, according to Bloomberg (Bloomberg, 2020). According to the Indian Ports Association Report from 2021 and the IBEF report from 2020, the total cargo traffic volume handled at Indian major ports in the fiscal year 2020–21 was 672.606 million tones, down from 704.63 million tones handled in the fiscal year 2019–12, a decline in traffic tonnage of 4.58% overall. Patterns for performance data before and during the COVID-19 crisis were investigated to determine the impact of the COVID-19 on India's major seaports. Based on the availability of secondary data sources, quantitative analysis has been done for variables featuring cargo traffic volume and segment-wise cargo traffic volume for Indian main seaports for full-year data for the financial years 2019–20 and 2020–21. (Indian Ports Association Report, 2022). The findings show that major seaports in India will have a 3217 decrease in vessel call performance count for the fiscal year 2020 compared to the fiscal year 2019. For the fiscal year (2019 vs. 2020), Table 1 shows vessel performance and cargo tonnage handling for 12 main seaports in India.

<u>Table 1</u> shows performance data for India's major seaports for the fiscal years 2019–20 and 2020–21.

SL No	**Major Port**	**Traffic period**	**No of vessels**	**Total Cargo(In tones)**	**Percentage variation (2020 vs 2019)**
1	Kolkata Port Trust (Kolkata Dock &Haldia Dock Complex)	2019-20 2020-21	3595 3077	63983 61317	-4.17%
2	Paradip Port Trust, Paradip	2019-20 2020-21	1941 1899	112889 114849	1.57%
3	Vishakhapatnam Port Trust, Vizag	2019-20 2020-21	2253 1940	72744 68843	-3.76%
4	Kamara jar Port Limited, Ennore	2019-20 2020-21	914 762	31737 25878	-18.36%
5	Chennai Port Trust, Chennai	2019-20 2020-21	1807 1408	46749 43743	-6.58%
6	VO Chidambaranar	2019-20 2020-21	1165 1008	36056 31780	-11.5%

	Port Trust, Tuticorin				
7	Cochin Port Trust, Cochin	2019-20 2020-21	1767 1509	34058 31601	-7.55%
8	New Mangalore Port Trust, Mangalore	2019-20 2020-21	2803 2557	39045 36400	-6.56%
9	Mormugao Port Trust, Mormugao	2019-20 2020-21	705 659	16007 21893	36.07%
10	Mumbai Port Trust, Mumbai	2019-20 2020-21	6644 5704	60596 53203	-12.05%
11	Jawaharlal Nehru Port Trust, Mumbai	2019-20 2020-21	2908 2658	68443 64105	-5.15%
12	Deendayal Port Trust, Kandla	2019-20 2020-21	3708 3654	122506 117443	-4.11%
	Total for no of vessels & cargo tonnage of east coast major seaports	2019-20 2020-21	11650 10082	363976 346959	-4.67%

	Variation in no of vessels & cargo tonnage for east coast major seaports (Sl. No 1 to 6)		1568	17017	
	Total for no of vessels & cargo tonnage of west coast major seaports (Sl. No 7 to 12)	2019-20 2020-21	18652 17001	340942 325546	-13.71%
	Variation in no of vessels & cargo tonnage for west coast major seaports (Sl. No 7 to 12)		1658	15403	
	Total no of vessels & cargo tonnage for all major seaports	2019-20 2020-21	30100 27074	704924 670506	-4.49%

	in India (Sl. No 1 to 12)				
	Variation in no of vessels and cargo tonnage for all major seaports in India (Sl. No 1 to 12 FY 2020-21 v/s FY 2019–20)		3317	63806	

Also, analysis of vessel call performance data, segment-wise cargo traffic volume data, and cargo traffic volume data has been done. Moreover, data analysis based on ports designated as east coast major seaports (six seaports) and west coast significant ports was conducted (six seaports). For major seaports in India, total cargo traffic volume decreased by 4.59% in 2020 compared to 2019. Except for two ports, Mormugao Port Trust (37.06%) and Paradip Port Trust (1.65%), the results show that major seaports saw negative cargo growth during the study period. Even though there were declines in all of India's major ports, there were disparities between the major ports on the east and west coasts of the country in terms of cargo traffic volume, vessel call performance, and segment-by-segment cargo traffic volume information.

Table 1 : It shows that cargo traffic volume and vessel call performance for major seaports on the east and west coasts have decreased. For the study period (financial years 2020 and 2019), the number of vessel calls decreased by 1568, and cargo traffic volume decreased by 4.67% for key seaports along the east coast. At major seaports on the west coast throughout the study period, the number of vessel calls declined by 1649, and the amount of cargo flow decreased by 13.72%.

A graphic representation of cargo traffic volume by India's main seaports during the study period is shown in *Fig. 4.1*. Also, analysis of vessel call performance data, segment-wise cargo traffic volume data, and cargo traffic volume data has been done.

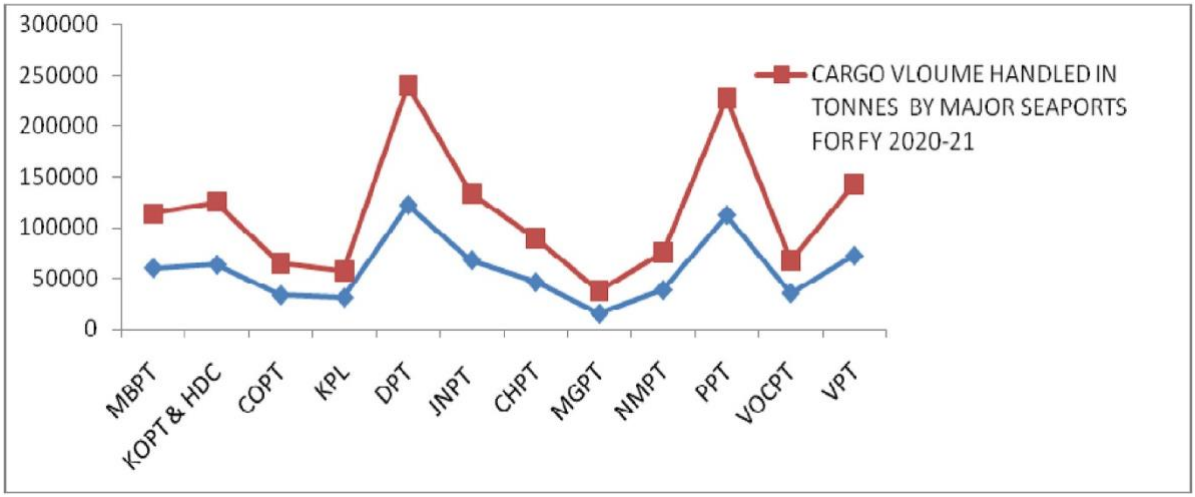


***Fig 4.1* Graphical representation of cargo traffic volume by major seaports in India for FY 2019 v/s FY-2020.**

Moreover, data analysis based on ports designated as east coast major seaports (six seaports) and west coast significant ports was conducted (six

seaports). For major seaports in India, total cargo traffic volume decreased by 4.59% in 2020 compared to 2019. The findings show that the remaining major seaports experienced negative cargo growth during the research period, with the exception of two ports: Mormugao Port Trust (37.06%) and Paradip Port Trust (1.65%). There were disparities between India's east coast region major ports and west coast region major ports in terms of cargo traffic volume, vessel call performance, and segment-wise cargo traffic volume statistics, even though decreases were noticeable throughout all of India's major ports.

Table 1 also shows that cargo traffic volume and vessel call performance for major seaports on the east and west coasts have decreased. For the study period (the fiscal years 2020 and 2019), the number of vessel calls decreased by 1568, and the amount of cargo traffic decreased by 4.67% at key seaports along the east coast. For the study period, the number of vessel calls declined by 1649, and the amount of cargo traffic decreased by 13.72% in key seaports along the west coast. A graphic representation of cargo traffic volume by India's main seaports during the study period is shown in *Fig. 4.1*.

A graphic representation of vessel call performance by Major Seaports in India during the study period is shown in *Fig. 4.2*. Also, as shown in *Table 2*,

segment-wise cargo traffic volume information for the study period are conducted for major seaports in India.

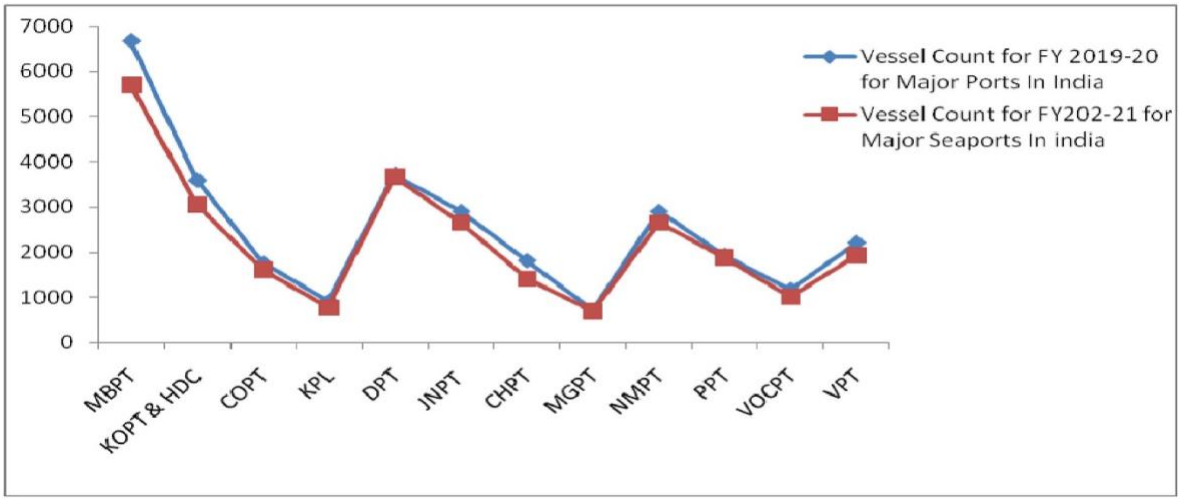


Fig 4.2. Graphical representation of vessel call performance handled by major seaports in India for FY-2019 v/s FY-2020.

Table 2. Segment-wise cargo details (in 000 Tones) for seaports in India for FY-2019 and FY-2020.

Time period	**Liquid cargo**	**Ire ore**	**Fertilizers**	**Coal**	**Containers**	**Other cargoes**	**Total cargoes**
FY 2020	234975	71025	19688	132075	9622	72842	672706
FY 2019	266810	55020	15933	149342	9985	71000	704926
Difference (2020 vs 2019)	-31738	16017	3776	-17221	-374	1832	-32321
Percentage variation of cargoes (2020 vs 2019)	-11.9	29.11	23.71	-11.5	-3.75	2.42	-4.59

Only iron ore cargo, fertilizer cargo, and other miscellaneous cargo showed positive increase for the year 2020 compared to the same period in the year 2019, according to the statistics. In contrast to the same period in 2019, the statistics show that liquid cargo will increase negatively by 11.9%, coal will grow negatively by 11.5%, and container freight will grow negatively by 3.75% in 2020. Moreover, the volume of cargo traffic in major seaports has decreased overall by 4.59%. The graphical representation of the segment-wise cargo volume handled by India's major seaports for the years 2020 and 2019 is shown in *Fig. 4.3*.

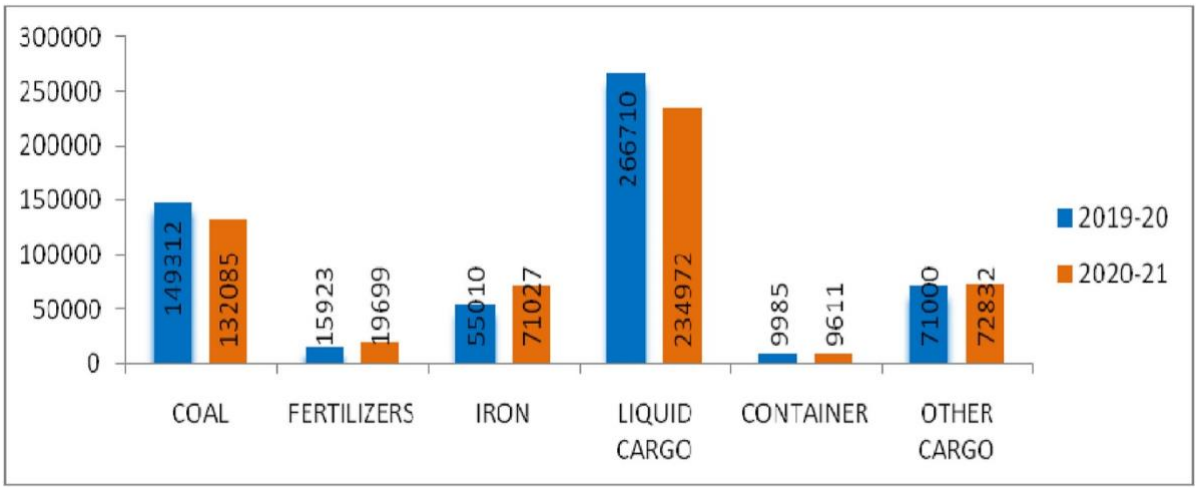


Fig 4.3. Graphical representation of segment-wise cargo volume for major seaports in India for FY-2019 & FY-2020

CHAPTER 5

RESEARCH METHODOLOGY

It is essential to hear the opinions and recommendations of subject-matter specialists in the field of seaport transportation and maritime logistics because of the diversity of unknowns and uncertainties surrounding COVID-19 and its effects. Unfortunately, there isn't a study from the viewpoint of authorities in Indian maritime-related fields. This expert survey was created by consulting the International Conference on Transport Research Society's COVID-19 Task Force survey and the Maritime UK COVID19 expert survey, both of which were conducted online. A survey of specialists was conducted to get their opinions on the marine supply chain and seaport transportation in India.

The extent to which seaports and other maritime stakeholders are prepared, the actions taken by the government and maritime organizations to handle the COVID-19 pandemic situation, the identification and response to post-pandemic recovery actions, and the formulation of various strategies that are required to be adopted by maritime businesses in India following the COVID-19 pandemic were all topics covered in the expert survey. There were five sections to the expert survey questionnaire.

The influence of COVID-19 on maritime and its logistics business in India is discussed next, followed by a selection question that includes elements that have a positive or negative impact on the maritime supply chain and seaport logistics operations in India. The final segment discusses the amount of

readiness among maritime chain stakeholders for the COVID-19 pandemic in India, the adaptation of chain operations during the epidemic, and changes to marine organizations long-term strategies in India as a result of the pandemic.

After that, queries were based on criteria for evaluating the government's response to COVID-19 on maritime-related business in the context of India. Answers were limited to a Likert-type scale with a five-point scale, with "no effect" denoted by a 1 and "strongly influenced" denoted by a 5. The necessity for government help for the maritime industry's recovery was raised as a response to this query. The questions that followed focused on recovery issues related to creating a recovery plan for maritime businesses following the epidemic. A query based on long-term changes brought about by COVID-19 on maritime chain commerce in the Indian setting followed this one. A five-point Likert-style scale, from "completely disagree" to "totally agree," was used to record responses. A ranking of the variables (from 1 to 9) for starting a maritime-related firm in India to offset the effects of COVID-19 followed this query. An optional descriptive question was included in the expert survey's last section to get information on ideas or proposals for recovery and developing post-COVID-19 pandemic policies for the marine transportation and seaport logistics sector in India.

The impact of the coronavirus on maritime and seaport-related activities in India was addressed by experts. According to 44.83% of specialists, COVID-19 had a substantial impact. Comparatively, 37.93% of experts indicated a

moderate effect, 14.94% reported a somewhat negative impact, and 2.3% reported that the COVID-19 impact had no influence on marine and port logistics.

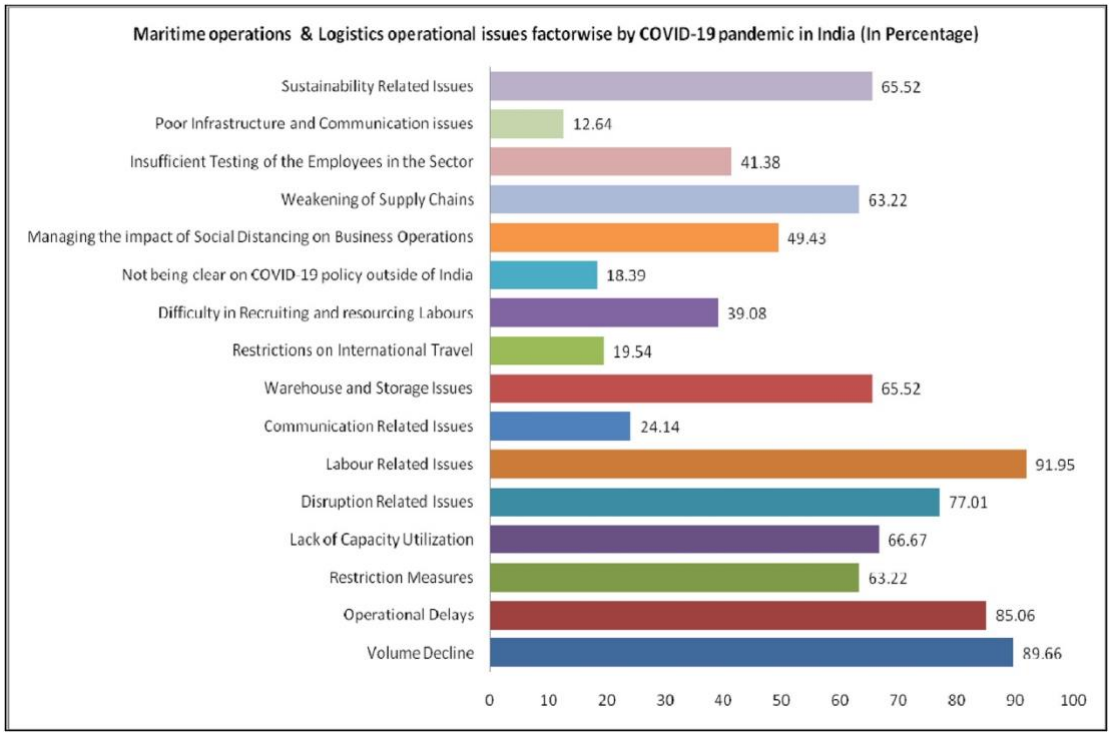
Table 3 shows the descriptive data on COVID-19's effects on marine and port logistics activities in India is

Variable	**Value**	**Frequency**	**Percentage**
Impact of Coronavirus on maritime related activities in India	Significantly affected	39	44.63
	Moderately affected	32	36.93
	Somewhat affected	12	15.94
	Not affected	2	2.4
	Unsure	0	0

According to experts, COVID-19's maritime operations and port logistical concerns were negatively impacted by maritime domain percentage-wise elements. The top six elements that negatively impacted marine operations and port logistics during COVID-19 were determined and ranked by experts. At COVID-19, 92% of expert respondents said that labor-related issues were the biggest factor affecting marine operations and port logistics, followed by 90% of experts who said that a reduction in cargo volume was the second-biggest cause. Operational delays in the maritime chain, which were

considerations according to 85% of experts, were placed third by respondents, followed by disruption difficulties in maritime chains, which were ranked fourth by 77% of respondents. Lack of capacity utilization in seaports was cited by 67% of respondents as the fifth most important problem, and 66% of respondents indicated that sustainability-related concerns and restriction measures had a detrimental influence on marine operations and port logistics during COVID-19.

Fig5.1 Depicts the graphical representation of factor-wise issues contributing to adverse effects on maritime operations by the COVID-19 pandemic

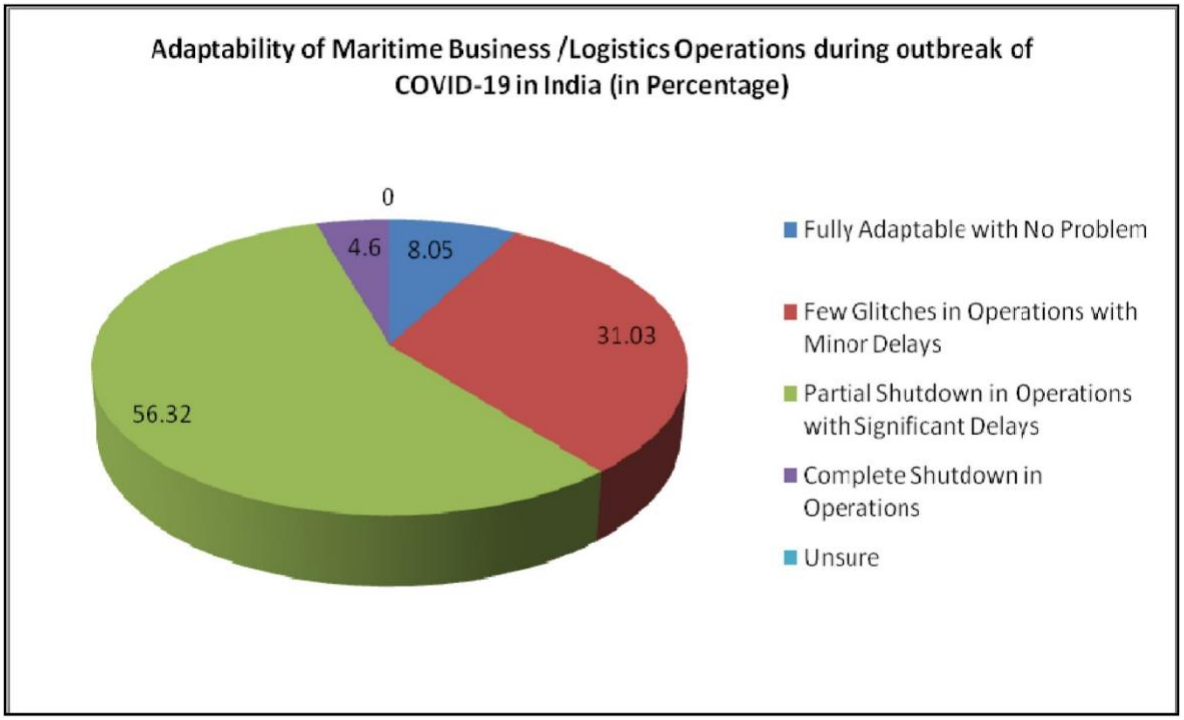


Preparedness & adaptability

On the flexibility of port logistics and maritime commerce during the COVID-19 epidemic in India, experts reacted. During the COVID-19 epidemic in India,

61% of specialists acknowledged a partial or whole halt in activities with considerable delays for marine business & seaport logistics operations. Comparatively, according to 31% of experts, there were minimal operational hiccups and small delays for maritime chain activities, while according to 8% of experts, maritime organizations were fully able to respond to the COVID-19 outbreak in India.

Fig5.2 Depicts the graphical representation of the adaptability of maritime organizations and stakeholders for COVID-19 in India.



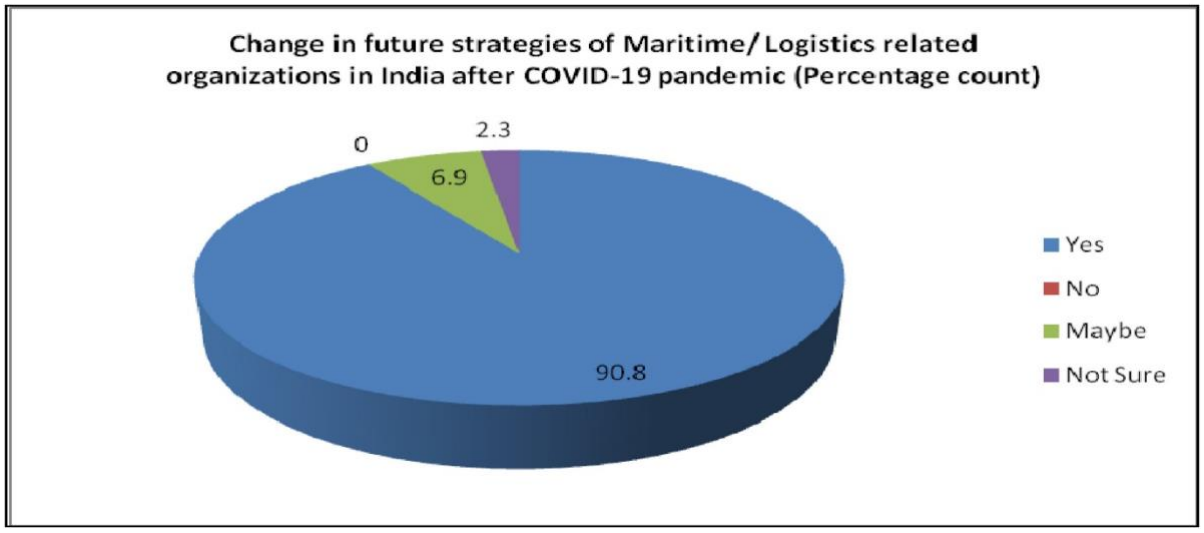
Experts believe that the lack of critical infrastructure facilities, low levels of early warning technology usage, convergence of COVID-19, low levels of access control to identify potential risk sources, and uncertainty surrounding

the impact of policies all contribute to the maritime industry's low level of adaptability.

Response and recovery

The future plans of maritime & port logistics-related firms in India would change following COVID-19, according to experts. 91% of experts concurred that the policy would change in the future. In contrast, only 2% of experts said they were unsure about whether the strategy of marine and port logistics-related businesses in India will change following COVID-19, while 7% said there might be changes.

Fig5.3 Depicts a graphical representation of change in future strategies of Maritime & Logistics related organizations in India after COVID-19.

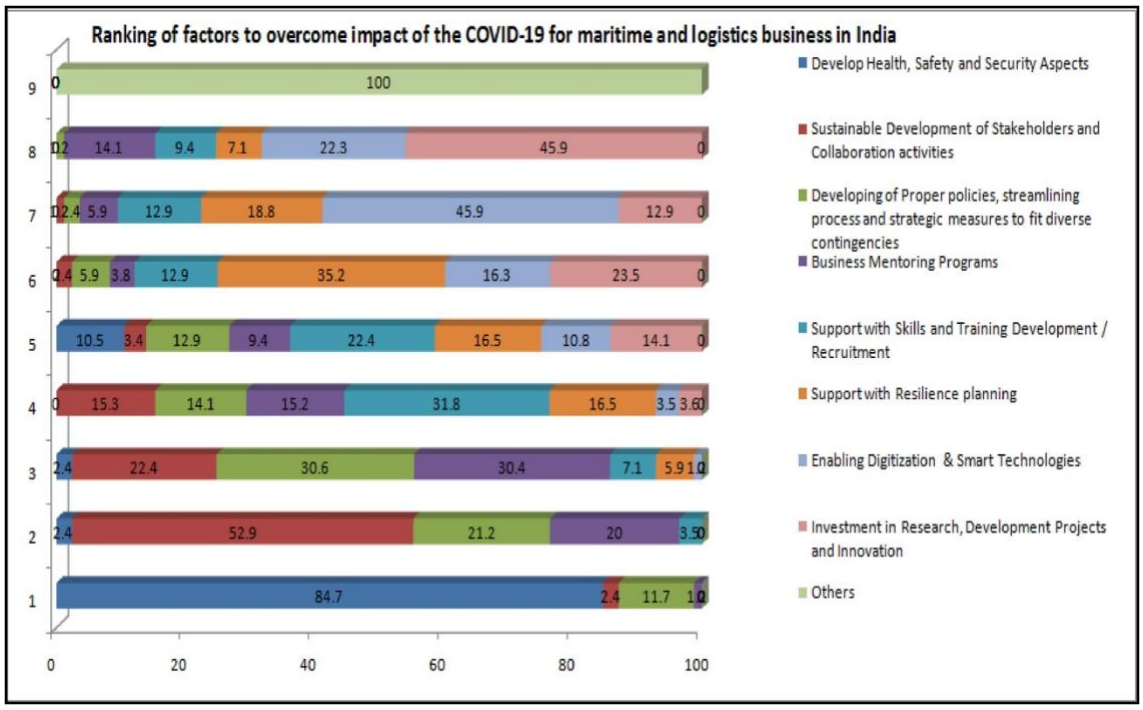


The expert's response also emphasized the necessity of government assistance for the COVID-19-related business recovery of Indian maritime chain firms. 37% of experts responded that there is a need for government

support to maritime domain organizations in India for a period of 6 to 12 months; 25% of experts reported the response with the need for government support for a period beyond 12 months; 20% of experts responded that no assistance is needed from the government at the moment; and 18% of experts responded that there is a need for government support to maritime organizations in India for a period of more than 12 months.

In order to help the maritime and seaport logistics industry in India overcome the effects of COVID-19, experts reported the criteria using a ranking system expressed as a percentage. The top five factors were determined and ranked, and they are as follows: improving proper policies, streamlining the procedure and strategic measures to fit various contingencies; business mentoring programmed and support with skill and training development, including recruitment; developing health, safety, and security aspects of maritime stakeholders; sustainable development of stakeholders and collaboration activities.

Fig5.4 Depicts the graphical representation for ranking the factors to overcome the impact of COVID-19 for seaport transportation maritime logistics business in India.



Discussion of policy implications

Around 1% of India's GDP growth comes from seaports, but the country's maritime industry has been constrained by a number of procedural, procedural, and policy-related issues, including poor port infrastructure, an unfavorable mix of transport modes for moving freight, poor hinterland transport connections, poor access to coastal and inland shipping, a lack of digitization and mechanization, and procedural bottlenecks at various ports. The COVID-19 epidemic has highlighted the necessity for increased healthcare spending nationwide and for ports to take on greater social responsibilities. The COVID-19 virus's ability to spread and how various countries react at various pandemic stages also have a significant role in the impact. In response to a COVID-19 Pandemic outbreak, the Indian government has made special

exceptions to the functioning of seaports for cargo transit in order to maintain a steady supply of products in the nation. In response to a COVID-19 Pandemic outbreak, the Indian government has made special exceptions to the functioning of seaports for cargo transit in order to maintain a steady supply of products in the nation.

The Ministry of Port, Shipping, and Inland Waterways has implemented the following measures to ensure smooth maritime operations and to manage COVID-19, including the following: waiver of the penal fee; digitization initiatives; force majeure on works; port safety measures; waiver of all fees for vessels carrying oxygen and oxygen-related equipment cargo at major ports in India; use of seaport CSR funds to medical and community development initiatives during pandemic; (Ministry of Ports, 2021; IPA, 2021). With the use of Covishield and Covaxin as vaccines at various stages, India began its countrywide vaccination programmed against the SARS-CoV-2 virus that caused the COVID-19 pandemic on January 16, 2021. (MOHFW India, 2021).

Since they offer a basis for comparison between circumstances before and during COVID-19 detection in the Indian maritime context, the findings of cargo traffic volume, vessel call performance, and segment-wise cargo traffic volume are objective, accurate, and reliable data that are continuously gathered throughout major seaports. Data for cargo traffic volume, vessel call performance, and segment-wise cargo traffic volume could indicate marine

sociocultural and economic activities as well as, to some extent, the likelihood of stakeholder involvement as a result of this study. The findings show that the volume of cargo traffic, vessel call performance, and the majority of segment-wise cargo traffic volume in major seaports are all declining. The outcomes could be interpreted as a reflection of the Indian seaport transportation and maritime supply's slow economic growth and rising unemployment. The results of the online expert survey have significant ramifications for India's marine supply chain and seaport traffic. According to this report, COVID-19 has a significant percentage of an impact on the marine supply chain and seaport transportation activities in India. Therefore, maritime policymakers should critically assess the key unfavorable aspects of the COVID-19's consequences on the marine sector. The study also found that maritime organizations and stakeholders are only partially prepared for the COVID-19 pandemic condition.

Low percentage results during the COVID-19 situation indicated that the maritime industry had to deal with issues in adaption due to a lack of operational readiness. Given that multiple pandemics have already occurred in the maritime environment of India, maritime policymakers should study why there was a lack of preparations and difficulty in adapting and take seriously the fact that only a small portion of the population was fully prepared. To lessen the effects of a pandemic, efforts must be directed towards creating a framework and set of guidelines for maritime stakeholders,

creating a business continuity plan, a national logistics policy, a consolidated national institutional framework, and a disaster management plan for emergency situations.

Also, it is noted from the expert assessment that there is a significant likelihood that organizations in India may alter their future plans in the wake of the COVID-19 epidemic. The results of the expert analysis show that the COVID-19 digitization revolution reforms will cause long-term changes in the Indian marine sector (e.g., the concept of online work from home, online maritime training & education services, online maritime stakeholder activity services). Better tools and forecasting techniques are required for cargo owners and marine transport service providers to anticipate interruptions and increase the flexibility and transparency of the maritime supply chain. The physical safety of their organizational personnel and marine chain stakeholders should be given top priority by maritime authorities and policymakers, according to the research study. They should implement the appropriate emergency response protocols to guarantee that ports and shipping operations continue to operate normally. The study's recommendation for the government's short-term course of action is to support marine stakeholders through fiscal measures and make sure that the social and economic systems are returned to their pre-COVID-19 condition. The government must work together with the commercial sector and other maritime stakeholders to develop a coordinated response.

In addition to the primary concern of ensuring more employment opportunities and cost structure control for impending public health threats, support is also provided in the form of business recovery, quality information delivery with appropriate communication, improvement of resilience & sustainability processes in the sector. Also, the government must create macroeconomic, fiscal, marine trade, and labor growth policies that support innovation and promote private sector involvement. The government must remove obstacles to industrial growth in order to encourage the localization of maritime supply chains, which is essential during times of crisis. To foster shipping and marine innovation and boost national competitiveness by encouraging renewable energy, resilient infrastructure, and digitization, the government should establish post-crisis innovation funding and forge connections between small maritime businesses and research groups. The situation presents a significant task for seaport transportation and marine decision-makers, but it also presents a chance to learn from the developments, contribute to containing numerous pandemic waves, and get ready for a post-COVID-19 world. In order to anticipate interruptions and increase the flexibility and transparency of the maritime supply chain, marine transport service providers and cargo owners must have better forecasting techniques and technologies. The COVID-19 epidemic has brought to mind previous breakouts, and it is acknowledged that fresh pandemics may damage businesses in the future due to limitations and delays in trade cycles. The infrastructure and operations of

seaports need to be adjusted in order to accommodate new operational patterns.

In order to mitigate the effects of COVID-19 in the post-pandemic recovery period, government and marine policymakers may take a variety of long-term supporting factors and policies, including the following:

- The complete operational functionality of the maritime chain, the development of marine clusters, the alleviation of financial distress of the maritime stakeholders through the provisional restoration of the maritime transport services, environmental protection initiatives, community development, information sharing by various maritime stakeholders, training & education on COVID-19 through knowledge exchange & conferee
- Establishing appropriate shipping-related policies, streamlining the method, and taking strategic actions to address various situations (e.g., adhering to standard operating procedures, reducing traffic, promoting working from home, boosting capacity);
- Assistance with planning for maritime resilience (e.g., development of maritime crisis cell, resilience infrastructure development, develop business continuity plan & disaster management plan for the emergency circumstances to handle critical activities of maritime supply chain and port logistics)
- Enabling digitization and smart technologies for maritime chain activities (such as automating maritime services, allowing access to documents in

digital form throughout the supply chain, and using intelligent systems like AI, IoT, big data, and block chain technologies);

- Investment in R&D projects and innovation concepts related to the maritime supply chain (e.g., reactivate/new investment projects, industry-academia collaborative research).

CHAPTER 6

CONCLUSION

The purpose of this project is to examine the effects of COVID-19 on seaport transportation, the maritime supply chain industry, and challenges that are associated with it in India. The first part of this study paper explores and summarizes the effects of COVID-19 on the state of the world's seaports at the moment. By the analysis of performance data before and after the COVID-19 crisis using secondary sources, this research explores the effects of COVID-19 on India's major seaports. The main conclusions of this study show that there has been a decrease in vessel call performance, overall cargo traffic volume, and the majority of segment-wise cargo traffic volume during the COVID-19 period compared to the period before to the COVID-19. To combat the effects of COVID-19 on Indian maritime domain organizations, a long-term recovery strategy for organizations is required, as is support from the government. If a future pandemic is going to have comprehensive redress within the maritime trade, with minimal crises unlike those seen in the Covid-19 crisis, further research is necessary to accurately determine the amount of the impact on the health of marine employees and also business. To ascertain the effect of COVID-19 on the marine supply chain and seaport transportation, the work described in this study can be expanded to international seaports. Future studies should also consider collaborative research with other maritime technical domains to assess COVID-19's effects on the marine environment.

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