"A study on green and sustainable port practices adopted at Chennai port trust"

A

Project Report

Submitted To

Indian Maritime University, Chennai

In partial fulfilment of the requirements for the award of degree of

Master of Business Administration** in **International Transportation and Logistics Management

Under Guidance of

Dr. Emil Matthew

Assistant Professor

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Declaration

I, **Mohit.B** (Reg. No 2003305020), hereby declare that the project report on **"**Factors affecting turnaround time of container terminal in Indian major ports**"** submitted to **Indian Maritime University, School of Maritime Management, Chennai** in partial fulfilment of the requirements for the award of degree **Master of Business Administration** in International Transportation and Logistics Management, under the supervision of **Dr. Emil Matthew** Assistant Professor, School of Maritime Management, Indian Maritime University, Chennai.

This submission represents idea of mind in my own words and where ideas or words of other have been included. I have adequately and accurately cited and referred the original sources.

Place: Chennai **Mohit.B**

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The completion of this project is not just due to the efforts of one single person; rather it bears the number of persons who directly or indirectly guided me and helped me to complete the internship.

Thanking you

Certificate

School of Maritime Management
Indian Maritime University, Chennai.

This is to certify that the project report entitled "A STUDY ON GREEN AND SUSTAINABLE PORT PRACTICES ADOPTED AT CHENNAI PORT TRUST.", submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus., in partial fulfilment for the award of the degree of Master of Business Administration in Port & Shipping Management/ International Transportation and Logistics Management, is a record of work carried out entirely by MOHITH B, Reg. No. 2003305020

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EXECUTIVE SUMMARY

Ports in the Big Picture Shipping has allowed people all around the world to collaborate for millennia. The present shipping business is a complex, global jigsaw puzzle with many moving pieces. Significant developments have happened in the previous several years. The prominence of East Asia has risen rapidly, with China at the forefront. We might even argue that globalisation as we know it would not have happened without shipping. Shipping is now often recognised as the most efficient and ecologically benign means of transporting goods across long distances. Shipping would continue to play a significant role in the transportation system. Cartels and bilateral agreements have substituted free markets. Growth in the economy is restricted and unequally distributed. Resources have become a source of power due to their scarcity.

Many nations continued to shift away from coal in favour of less carbon-intensive, cleaner energy alternatives, lowering coal consumption. While this is true in terms of coal imports to Europe, coal remains a key source of energy in many developing nations and an important export commodity for countries such as Australia, Colombia, and Indonesia. Coal continued to be a key cargo import for Southeast Asian countries, notably Indonesia, Korea, and Vietnam. Climate change is seen as a threat rather than an opportunity, and the problem can only be addressed locally and regionally. As a consequence of environmental changes, desalination, waste management, and recycling ships are docked outside megacities, meeting their demands. India has a 7516.6-kilometer coastline, making it one of the world's biggest peninsulas. The coastline length of the Indian mainland is 5422.6 kilometres, whereas the aggregate coastal length of the islands is 2094 kilometres. The longest coastline is in Gujarat, while the shortest is in Goa. India has the world's 18th longest total coastline length of any country. The Indian coastline is formed by the Arabian Ocean in the west and the Bay of Bengal on the east, and it encompasses nine states and four union territories. The western coastal states include Gujarat, Maharashtra, Goa, Karnataka, and Kerala, whereas the eastern coastal states are Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal. Andaman and Nicobar Islands, Daman and Diu, Puducherry, the Lakshadweep Islands, and the Andaman and Nicobar Islands

CHAPTER 1

Green and Sustainable Port Practices Adopted at Chennai Port Trust

Introduction

Global Scenario of ports For millennia, shipping has allowed people all across the world to collaborate. The current shipping industry is a sophisticated, worldwide jigsaw with a lot of moving parts. In just the last few years, substantial changes have occurred. East Asia's importance has grown quickly, with China in the forefront. We could even argue that without shipping, globalisation as we know it would not have occurred. Shipping is currently regarded as the most effective and environmentally friendly method of carrying products over vast distances. Shipping would remain an important aspect of the transportation system. Free markets have been supplanted by cartels and bilateral agreements. The economy's growth is constrained and unequally distributed. Because resources are limited, they have become a source of power. Nations' wealth is distributed unequally.

As a result of two main developments, an increase in bilateral agreements and businesses shifting to resource areas, new trade routes have formed. The entire logistical chain is regionally optimized. The era of flags of convenience (registering a ship in a foreign country to dodge regulation) is coming to an end. Oil tankers are becoming less common, and LNG vessels are taking on a larger role. Smaller ships are more efficient in regional trade. Container traffic has decreased as a result of changing product patterns, and some large container terminals have closed. Ports are generally under the control of national governments. Ports serving developing-country trade, particularly smaller and secondary ports, will need to adapt in order to remain competitive and attract business through direct linkages. In addition to safeguarding the operations of smaller ports, it is critical from a shipping and trade viewpoint to reduce the costs and delays that these ports impose on trade and supply chains.

Positive trends in population expansion, urbanisation, infrastructure development, construction activity, and industrial and steel output, particularly in Asia's quickly expanding developing countries, have impacted bulk terminals globally. In recent years, dry bulk commodities have dominated international seaborne trade volumes, accounting for over half of all global seaborne trade flows in 2017. Growing environmental sustainability imperatives affected trends in coal 4 trade volumes in 2017.

Many countries maintained their move away from coal in favour of less carbon-intensive, cleaner energy sources, reducing demand for coal. While this may be true in terms of coal imports to Europe, coal continues to be a major source of energy in many developing countries and a vital export commodity for countries like Australia, Colombia, and Indonesia. Coal remained a major cargo import for countries in Southeast Asia, particularly Indonesia, the Republic of Korea, and Vietnam. Climate change is viewed as a threat rather than an opportunity, and only local and regional solutions exist to address the problem. Desalination, garbage management, and recycling ships are anchored outside megacities, providing their demands, as a result of environmental changes.

The majority of major shipping corporations are Chinese-owned, and trade routes have evolved to reflect Chinese trade interests. In Africa, Eastern Russia, and India, new ports are being built, and Chinese ports have evolved into sophisticated, integrated logistics centres Digitalization is a rapidly emerging issue with potentially significant ramifications for port operations and management. A mix of technologies that are becoming increasingly prevalent across mechanical systems, communications, and infrastructure is driving the latest breakthroughs in digitalization. Innovations such as the Internet of Things, robotics, automation, artificial intelligence, unmanned vehicles and equipment, and block chain are key technologies aiding digitalization in maritime transport. The use of such advances at ports pervades all parts of port operations, including planning, design, infrastructure construction, and maintenance.

They provide ports with new options by unleashing additional revenue beyond typical cargo-handling activities. Relevant technology can aid in traffic optimization, operational efficiency, process transparency, and speed, as well as automating procedures and reducing costs mistakes and inefficiencies. Changes to loading and unloading operations (machine-to-machine communication, platform solutions, robotics, intelligent asset development, and mobile workforces), storage (big data analytics, smart metering, and single views of stock), and industrial processing (smart grids, smart energy management, three dimensional printing, safety analytics, and predictive mains) are just a few examples of how innovative technologies will likely be felt in ports.

Errors and mistakes Ports and terminals gain from private terminal operators' engagement not just in terms of finance, but also in terms of experience and technology transfer. Over the last three decades, public–private partnerships have grown in popularity as a way to attract more private investment in port development and, more importantly, to gain access to specialised skills, innovations, and new technologies associated with infrastructure development, operation, and 5 maintenance. Because today's ports systems necessitate highly specialised

managerial and operational skills, as well as cutting-edge technologies, private sector expertise in developing, operating, and maintaining transportation infrastructure and services is valuable, and it, along with funding, is a valuable resource.

The region's port industry has changed, although in diverse ways and to varying degrees in each country. In general, the sector has been controlled, and national port policies have been established, which were previously lacking in many cases. State monopolies in port operation and administration have been modified by decentralising port operations to local governments and/or providing concessions to the private sector. Trends and advancements in the marine industry, as well as port owners' efforts to adapt port development strategies to the century's global concerns. I Global port operators will continue to expand into new geographic areas, leveraging technology to build global port networks with consistent standards of service and modes of operation.

Port terminal operators will form more coalitions to promote economies of scale and the usage of global capacity. (ii) Due to the substantial capital investments, only the most powerful companies with significant financial resources will remain in these partnerships. (iii) To accommodate mega-ships, port facilities will be upgraded to higher standards and equipped with cutting-edge technology. (iv) New technologies and facility designs must be implemented to increase container storage capacity. (v) For a world run by computers, there will be tremendous investment in communications and information technology. Seaports continue to underpin globalised manufacturing processes, market access, and effective integration in the global economy as essential players in international trade and logistics and critical nodes in global supply chains. World seaports are important infrastructural assets that support shipping and trade, and their performance is heavily influenced by global economic and trade trends. Cargo-handling activity and throughput in worldwide ports improved overall in 2017, reflecting a recovery in the global economy and a comeback in trade volumes, which bolstered shipping demand and seaborne trade.

Because ports handle more than 80% of global commercial traffic in volume, and roughly two-thirds of this trade is loaded and unloaded in developing country ports, the strategic importance of well-functioning and efficient ports for growth and development cannot be overstated. Ships and cargo are served by global ports at various stages of port-handling operations, from the shore to the berth, yard, and landside. As a result, improving port efficiency throughout the various cargo and vessel handling phases is critical for overall efficiency to ensuring that gains made in one part of the marine logistics chain are not offset by inefficiencies elsewhere in the process.

1.1 Indian port scenario

India has a shore line of around 7516.6 kilometres, making it one of the world's largest peninsulas. The Indian mainland's coastal length is 5422.6 kilometres, whereas all of the islands' combined coastal length is 2094 kilometres. The state of Gujarat has the longest coastline, while Goa has the shortest. India has the 18th longest total coastal length of any country in the world. The Arabian Sea on the west and the Bay of Bengal on the east form the Indian coastline line, which spans nine states and four union territories. Gujarat, Maharashtra, Goa, Karnataka, and Kerala are the western coastal states, whereas Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal are the eastern coastline states. Daman & Diu, Puducherry, the Lakshadweep Islands, and the Andaman & Nicobar Islands are the four union territories.

There are 12 major ports in the country 6 on the eastern coast and 6 on the western coast. Less than 54% of the total cargo is being handled at 12 major ports in India. Major ports are under the jurisdiction of the Government of India and are governed by Major Port Trusts Act 1963, except Ennore port, which is administered under the Companies Act 1956. Kolkata-Haldia (West Bengal), Visakhapatnam (Andhra Pradesh), Paradip (Orissa), Ennore (Tamil Nadu), Chennai (Tamil Nadu), and Tuticorin (Tamil Nadu) are the major ports on the eastern coast (Tamil Nadu). Kandla (Gujarat), Mumbai (Maharashtra), Mormugao (Goa), Mangalore (Karnataka), Cochin (Kerala), and Jawaharlal Nehru Port in Navi Mumbai are the western coastline ports (Maharashtra). 14 India has 205 non-major ports. Non-major ports accounted for 46% of the total cargo traffic at Indian ports in FY21. Non-major ports come under the jurisdiction of the respective state Governments' Maritime Boards (GMB)

Advantages of Indian ports

1. Robust demand In FY20, India's major ports handled 704.82 million tonnes of cargo traffic, representing a 2.74 percent CAGR from FY16 to FY20.

2. Attractive opportunities In 2020, total investment in Indian ports is expected to be US$ 43.03 billion. In FY22, the principal ports are anticipated to deliver seven public-private partnership projects valued more than Rs. 2,000 crore (US$ 274.31 million). The Finance Minister proposed that ship recycling capacity be increased to 4.5 million light displacement tonnes (LDT) by 2024, resulting in an additional 1.5 lakh job possibilities in India. By the end of May 2021, India is scheduled to be fully operational in Iran's Chabahar Port. India will construct two terminals at the port and operate them for a period of ten years.

3. Policy support The government promised subsidy financing for Indian shipping businesses totaling Rs. 1,624 crore (US$ 222.74 million) in the Union Budget 2021 to stimulate merchant ship flagging in the country. The Marine Aids to Navigation Bill 2021, which incorporates global best practises, technical improvements, and India's international duties in this field, was passed by Parliament in July 2021. The Major Port Authorities Bill, 2020 was passed by the Indian Parliament in February 2021. The law intends to match the governance model in central ports with best practises from throughout the world.

4. Competitive advantage India's coastline stretches for more than 7,517 kilometres and is punctuated by more than 200 ports. The majority of cargo ships travelling between East Asia and the United States, Europe, and Africa transit via Indian territorial waters. 15 Cargo traffic handled at major ports of India Maritime transport activity is influenced by global economic trends, such as increased output and commerce. As a result, the volume of seaborne cargo traffic handled by ports is primarily influenced by global and domestic activity levels and changes. During April-January 2020-21, cargo traffic at India's 12 major ports fell by 7.6% to 541.76 million tonnes, down from 586.21 million tonnes in April-January 2019-20. Maritime transport activity is influenced by global economic trends, such as increased output and commerce. As a result, the volume of seaborne cargo traffic handled by ports is primarily influenced by global and domestic activity levels and changes. During April-January 2020-21, cargo traffic at India's 12 major ports fell by 7.6% to 541.76 million tonnes, down from 586.21 million tonnes in April-January 2019-20. The amount of overseas cargo handled at major ports fell by 5.6 percent from 447.96 million tonnes in April-January 2019-20 to 422.87 million tonnes in April-January 2020-21. Coastal cargo handled at Major port fell by 14.0% from 138.25 million tonnes in April-January 2019- 20 to 118.88 million tonnes in April-January 2020-21. In January 2021, 64.38 million tonnes of cargo were handled at India's major ports, representing a 4.5 percent rise over the same period the previous year. Coastal freight handled at Major Ports declined by 4.5 percent in January 2021, from 14.72 million tonnes in January 2020 to 14.06 million tonnes in January 2021. In January 2021, however, the amount of overseas cargo handled at Major Ports increased by 7.4% to 50.32 million tonnes, up from 46.87 million tonnes in January 2020. Paradip Port handled the most cargo traffic of 11.17 million tonnes, accounting for 17.3 percent of all cargo handled at major ports, followed by Deendayal Port (16.7 percent), JNPT (10.1 percent), Vizag Port (9.5 percent), Mumbai Port (7.8%), SPM Haldia Dock Complex (7.1 percent), Chennai Port (6.6 percent), Cochin Port (5.1 percent), NMPT (4.8 percent), VOC Port (4.4 percent), Mormugao Port (4.1 percent), Kamar Port (4.1 percent (2.6 percent). Food grains excluding Pulses grew by 740.9 percent in January

2021, followed by Pulses (134.1 percent), Coking Coal (32.2 percent), LPG or 2 LNG (23.4 percent), and FRM-Dry (23.4 percent) (13.8 percent). Fertilizer (11.4 percent), POL Crude (11.3 percent), FRM Liquid (11.0 percent), Cement (7.9%), Containers (6.5 percent), Edible Oil (6.2 percent), Other Commodities (5.8%), and Other Coal (5.8%). (2.7 percent). In January 2021, Project Cargo had the largest negative growth rate of 65.5 percent, followed by Sugar (58.1%), Other Ores (18.5%), POL Products (18.0%), Iron and Steel (17.6%), and Thermal Coal (17.6%). (14.0 percent) 16 Cargo traffic handled during April-January 2021 Mormugao Port had the biggest growth of 28.2 percent in traffic handled at Major Ports from April to January 2020-21, followed by Paradip Port (0.2 percent). Kamarajar Port (25.9%), SPM Kolkata Dock System (18.5%), Mumbai Port (16.1%), Chennai Port (12.7%), Cochin Port (11.9%), VOC Port (11.7%), JNPT (9.8%), NMPT (7.5%), Deendayal Port (6.7%), Vizag Port (4.4%), and SPM Haldia Dock Complex (3.2%) were the major ports with negative traffic growth from April to January 2020-21. Deendayal Port handled the most cargo of 95.09 million tonnes (17.6%), followed by Paradip Port (17.3%), Vizag Port (10.7%), JNPT (9.5%), Mumbai Port (7.9%), SPM Haldia Dock Complex (6.9%), Chennai Port (6.4%), NMPT (5.3%), VOC Port (4.9%), Cochin Port (4.6%), Kamarajar Port (3.6%), Mormugao Port (3.2%), and SPM Kolkata Dock System (2.2%)

1.2 Environmental effects of shipping ports

The situation is now quite poor. Not just in the transportation business, but in all industries. Industry must keep up with continually growing demands as the human population continues to grow. The shipping sector now accounts for over 90% of all worldwide trade. This implies that most items are transported by maritime freight from one country to another. With each passing year, more cargo vessels are required to transport cargo around the world, resulting in the burning of more fossil fuels. Apart from air pollution, the maritime sector also produces noise and light pollution. The engines on ships are noisy and annoying. Large cranes regularly move containers, while loud vehicles carrying enormous cargo drive up and down. We're guessing you wouldn't want to live close by. Both human and marine life are disturbed by bright lights aboard ships and at ports. CO2 and other greenhouse gas emissions from ships are particularly problematic. These gases have been shown to play a significant role in rising global temperatures and climate change in general. They are also detrimental to humans, wildlife, and fragile ecosystems on land and in our oceans. The shipping sector emits roughly 940 million tonnes of CO2 each year, accounting for around 2.5 percent of global CO2 emissions.

According to an IMO research, if greenhouse gas emissions are not restricted, they might climb by 50-250 percent by 2050. In the previous 50 years, not much has changed in the shipping sector. It continues to run on the same fossil fuels as it has for almost a century. And ports continue to employ the same equipment to lift and carry cargo. Carbon dioxide, nitrogen oxides, sulphur oxides, and greenhouse gases are produced by vessels and machines that run on diesel and other fossil fuels. Ships discharge waste water, including sewage and bilge water, into the oceans. Bilge water is a mixture of unclean water and oil that affects ocean ecosystems, causing harm and the extinction of species. Plastics and defective maritime equipment are also dumped overboard by ships. The shipping sector is responsible for around 20% of all marine litter, and approximately 34% of all maritime rubbish ends up in the sea. This contributes to the formation of enormous rubbish islands in particular sections of the ocean. The Garbage Patch in the Pacific This trash patch currently occupies an area three times the size of France and twice the size of Texas. It's still expanding.

1.3 Sustainable shipping port

Ports that are environmentally friendly are the way of the future. They operate with the environment in mind, and they take efforts to reduce negative affects wherever feasible. The social, economic, and environmental implications, as well as business as usual, are all addressed in sustainable ports. Ports are the hubs that link ships all around the world. Any adjustments made in these areas can have a beneficial rippling effect on the rest of the industry. This is why the focus has been on developing viable ports before extending out. The International Maritime Organization's (IMO) regulations and the European Green Deal (EGD) are positive steps. Some of the IMO's most recent regulations include an emphasis on

- cleaner air: Sulphur oxide emissions from ships are being drastically reduced.
- Human health: Implementing measures to enhance air quality by minimising dangerous gas emissions.
- High-quality fuels: Using fuels that emit low amounts of pollution and are not detrimental to the environment.
- Release of industry rules that will be continuously monitored.

Improvement and innovation

Singapore, Taiwan, Hong Kong, and Rotterdam Ports: Automated Sustainability

Singapore, Taiwan, and Hong Kong are all undergoing port automation projects. Cranes and other potentially hazardous equipment will be controlled by computers in a control centre. To

operate the cars, employees no longer need to be inside. As a result, freight offloading has become more efficient. Software manages the Port of Rotterdam (Netherlands). Cranes may now be controlled remotely, lowering transportation expenses and increasing worker safety.

Sustainable and energy-efficient: San Diego Port (US)

Back in 2014, the Port of San Diego was one of the first ports to focus on energy saving. San Diego joined the Climate Action Plan, and their efforts have decreased greenhouse gas emissions by more than 56,000 metric tonnes.

The Port of Krishnapatnam

A strong emphasis on environmentally friendly methods Krishnapatnam has always prioritised ecologically friendly development. They hold annual tree-planting efforts, and more than 60% of the port is powered by wind. They also have well-organized water and sewage management systems that assist to decrease pollution and regulate emissions.

Sustainable port management: Port of Algeciras Bay (Spain)

Algeciras Brain Port 2020 is an initiative run by the Port of Algeciras Bay (ABP 2020). They're working on a new port management model that will use technology to increase port efficiency, security, and sustainability.

The most sustainable port in Germany: Hamburg Port

Hamburg demonstrates that environmental sustainability and economic prosperity can coexist. To decrease emissions when ships are parked, ship mooring sites are connected with onshore power hook-ups. The port has also been using sulphur-free fuels for its fleets since 2009

1.4 NEED AND SIGNIFICANCE OF STUDY

While ports are important for economic development and crisis response, the related marine traffic, commodities processing, and road and rail transportation pollute the environment. The energy required to run port operations is provided by fuel-powered cargo handling equipment, ships, vehicles, railways, and power plants. Greenhouse gases like carbon dioxide and particulate matter contribute to respiratory illnesses like bronchitis and pneumonia, as well as chronic lung and heart problems. Port emissions reductions would reduce air and water pollution, enhance the health of almost 3.5 billion people, and aid in the fight against climate change.

1.5 OBJECTIVES OF THE STUDY

- To analyse the green sustainable port practices at Chennai Port Trust.
- To evaluate the performance of green sustainable practices and its impact on the environment.

1.6 METHODOLOGY

This was a descriptive research project on Green and Sustainable Ports. The data for the study was gathered through a literature review, the Chennai Port Trust annual report, research papers, magazines, and printed materials, among other sources. The port users and persons involved in port operations, such as shipping firms, Main Line Operators, Freight Forwarders, Multimodal Transport Operators, and Port Agents, were the study's target demographic.

1.7 LIMITATION OF STUDY

- The data provided in the Chennai Port Trust annual report limited all analysis, and all data used in this study was secondary.
- The study's accuracy may be questioned due to time restrictions.
- Because market conditions are dynamic and change over time, our scope is limited.
- The implementation of these reforms faces several challenges. Introducing a new product or service into your organisation is dangerous, and it may cost you money and possibly clients. The same may be said about the shipping industry's long-term port development.

CHAPTER 2

LITERATURE REVIEW

2.1 Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs) -Anas S. Alamoush, Fabio Ballini & Aykut I. Ölçer

\Port sustainability studies are fast rising and are slanted toward environmental issues, but their results are scattered, making it impossible to analyse conclusions collectively. Using the critical literature review technique, this study intends to provide a framework that categorises port activities, measures, and implementation schemes (policy instruments to enhance adoption). The relationship between port sustainability and the UN Sustainable Development Goals (UN SDGs) is also underlined. Internal (port side) and external (ships and land transport) activities and measures are all part of port sustainability. Given the increased scrutiny and pressure on ports to improve their sustainable pathways, such as by addressing climate change and energy consumption, the identified ports' sustainability actions and measures, including the linkage with the UN SDGs, are broad and multifaceted, and are seen as a first step toward achieving far-reaching sustainable implementation.

2.2 Barriers to the Implementation of Strategic Corporate Social Responsibility in Shipping - Kum FaiYuen PhD, Candidate aJun MingLim

Strategic corporate social responsibility (CSR) entails the voluntary implementation of social and environmental actions to satisfy a company's stakeholders while still producing profits. When it comes to adopting strategic CSR, companies, particularly those in the shipping industry, sometimes confront difficulties. After analysing the literature, a list of impediments was created. Following that, 600 shipping businesses in Singapore were surveyed, and the obtained data was analysed using structural equation modelling. The findings revealed that important challenges to adopting strategic CSR in shipping include a lack of resources, a lack of strategic vision, a lack of measuring system, high regulatory criteria, and a low desire to pay for CSR. The data suggest that strategic CSR is influenced by both the macro- and micro-environments of the organisation, but to a lesser extent. Understanding these possible

roadblocks may help businesses avoid or overcome them, increasing their chances of adopting strategic CSR successfully.

2.3 Reviewing two decades of cleaner alternative marine fuels: Towards IMO's decarbonization of the maritime transport sector - Jeffrey, Dankwa Ampaha, Abdulfatah AbduYusuf b, Sandylove Afranea, ChaoJin, aHaifengLiuc.

Due to rising concerns about shipping industry emissions, the International Maritime Organization (IMO) has set goals to reduce CO2 intensity by 40% by 2030 and overall GHG emissions by at least 50% by 2050, using 2008 as a baseline. Clean alternative marine fuels have long been acknowledged as a feasible option for decreasing ship-related air pollution. The field is increasing at a pace of 15.8 percent, according to the findings, with the United States making substantial contributions. The most extensively explored alternative shipping fuel is liquefied natural gas. Researchers are now focusing on methanol, ammonia, and hydrogen fuels, according to current developments. The research community has primarily focused on the potential of different alternative fuels as a replacement for conventional marine fuels to limit emissions from the shipping sector from an environmental, technical, and economic perspective, as evidenced by the frequently used keywords and relevant articles.

2.4 Polish sea ports and the Green Port concept - Aneta Oniszczuk-Jastrząbek1, Barbara Pawłowska1 , and Ernest Czermański1 University of Gdańsk, Faculty of Economics, Armii Krajowej St., 81-824 Sopot, Poland The recent focus of action for port authorities has been to find a set of development and investment measures that would, on the one hand, ensure the expected technical and organisational conditions for port operations in the future while also incorporating a variety of social and environmental aspects necessary to maintain or improve the quality delivered in these two areas. The Green Port refers to a series of initiatives that have been particularly important to the port business in recent years, as opposed to prior efforts that were similarly intense but failed to reflect the needs of long-term growth. The word refers to a port that invests strategically to maintain compliance in all three areas: economics, society, and the environment.

2.5 Environmental Effects of Marine Transportation - Walker, T, Adebambo, O, Feijoo, M, Elhaimer, E, Hossain, T, Edwards, S, Morrison, C, Romo, J, Sharma, N, Taylor, S, Zomorodi, S.

Marine transportation is the backbone of global trade, transporting about 10 billion tonnes of containers, solid, and liquid bulk goods yearly across the oceans. Historically, shipping corporations and ports had little environmental control, but in the 1960s, unintentional oil spills caused significant coastal pollution and seabird mortality, prompting the International Convention for the Prevention of Pollution from Ships to be established (MARPOL). MARPOL is the main international convention to prevent marine pollution by ships from operational or accidental causes. Furthermore, the International Maritime Organization (IMO) employs a variety of measures to safeguard the maritime environment from shipping activity. Nonetheless, marine transportation has negative effects on the marine environment, such as air pollution, greenhouse gas emissions, releases of ballast water containing aquatic invasive species, historical use of antifoulants, oil and chemical spills, dry bulk cargo releases, garbage, underwater noise pollution; ship strikes on marine megafauna, risk of ship grounding or sinkings, and widespread sediment contamination of ports during transshipment or ship transport.

2.6 INEVITABILITY IN THE GROWTH AND DEVELOPMENT OF GREEN PORT OPERATIONS IN THE SEAPORTS OF CHENNAI CLUSTER

- Muralidharan Balasubramaniam Research Scholar, AMET Business School, AMET University, India Dr. J. Rengamani Professor, AMET Business School, AMET University, Chennai.

Today's global commerce has set a competitive benchmark in terms of the global market. As a result, compared to other forms of transportation, marine transportation has seen the greatest development. In such a competitive climate, ports in the nation have been able to expand to the same level as major logistics centres throughout the world. The phrase "green port" will help to ensure the country's marine transportation remains stable. By emphasising the benefits of large ports employing renewable energies, the Indian Ministry of Shipping is making significant strides toward green efficiency and sustainability. The government intends to install 91.50 MW of solar energy capacity at the country's twelve major ports. By utilising renewable energy for electricity generation, these initiatives will also assist to minimise the cost of power purchased. The Ministry of Shipping (MoS) has launched a project to build utility-scale solar photovoltaic power plants at a number of major ports around the country. SECI and the Indian Ports Association (IPA), on behalf of the individual port trusts, have inked an agreement to undertake solar energy projects. Grid-connected solar power plants are being installed in the

following ports as part of this effort. In addition, rooftop solar power projects are being installed at several ports, and the associated processes have begun.

2.7 Assessment of renewable energy supply for green ports - Ibrahim Sadek & Mohamed Elgohary.

Because of the large volume of exhaust gases released by their operations, seaports are one of the causes contributing to the degradation of the maritime environment. The bulk of seaports rely on the national electric grid to meet their domestic and ship-related power needs. The prospect of switching ports from relying on national grid electricity to green power-based ports is discussed in this study. Offshore wind turbines and fuel cell units are two examples of renewable energy sources for ports that look to be promising. The results suggest that the fuel cell is the greatest alternative for power generation, followed by a combination system of wind turbines and fuel cells. Additionally, utilising fuel cells with offshore wind turbines as a green power concept will result in CO2, NOx, and CO emissions being reduced by 80,441, 20,814, and 133,025 tonnes per year, respectively.

2.8 Renewable energy source selection for a green port with AHP - A Perwira Mulia Tarigan, Md Mobassurul Hasan, M Khairi Abd Wahab, Elhadj Dogheche, Achmad Djamaludin.

The green port idea is receiving a lot of attention because of the need to minimise greenhouse gas emissions that cause global climate change, as well as the need to maintain the ecosystem around port vicinities. The goal of this approach is to strike a balance between environmental issues and economic needs, allowing seaports to improve their financial, commercial, and operational performance. One feasible approach in this area is the usage of renewable energy. This research proposes a systematic technique for identifying the best acceptable renewable energy source alternative based on the analytical hierarchy process (AHP) method. Solar energy is the most preferred choice in the case of Kuala Tanjung Port, followed by wind energy, biomass, and wave energy. This study is intended to serve as a starting point for developing a long-term renewable energy strategy for a green port.

CHAPTER 3

INDUSTRIAL PROFILE

INTRODUCTION

The Port of Chennai, originally known as Madras Port, was founded in 1639 and is India's second-largest container port and third-oldest port. It's a port on India's east coast that serves as an emergency center. It commenced operations in 1881, however marine trading on the undeveloped beach began much earlier, in 1639.

Chennai Port, India's third-oldest port among the country's 12 main ports, is a growing hub port on the country's East Coast. The nation's marine trade has been served by its gateway port for all goods for 137 years. Maritime trading began on the seashore of Chennai around 1639. Until 1815, it was an open road with an exposed sandy shoreline. The first piers were completed in 1861, but they were rendered ineffective by the storms of 1868 and 1872. As a result, an artificial port was created, and operations began in 1881. The freight activities took place on the northern pier, which is located on the northeastern side of Chennai's Fort St. George. During the first few years of operation, the port handled 3 lakh tonnes of cargo and 600 ships.

As it was an artificial harbour, the port was susceptible to cyclones and the accumulation of sand inside the basin owing to underwater currents, reducing the draught. Sir Francis Spring, a visionary, devised a long-term strategy for charting the port's destiny in a scientific manner, overcoming both man-made and natural obstacles. The port's entrance was moved from the eastern to the north-eastern side, which sheltered it from natural hazards to a great extent by the end of 1920, the port had a dock with four berths in the West Quays, one in each of the East and South Quays, as well as transit sheds, warehouses, and a marshalling yard to make freight transfers from land to sea easier. Additional berths were constructed in the 1940s, including one at South Quay and another between WQ2 and WQ3.Following India's independence, the port began to grow and gain speed. The Port's topography altered in 1964, when the Jawahar dock was built on the southern side, with the capacity to berth six boats for dry bulk commodities such as coal, iron ore, fertiliser, and non-hazardous liquid cargoes.

In response to worldwide marine advancements, the port built the Outer Harbour, known as Bharathi Dock, in 1972 for the handling of petroleum and in 1974 for the automated treatment of iron ore. With a capacity of 8 million tonnes, the iron ore terminal is equipped with a

mechanised ore handling unit, one of three such facilities in the country. The Chennai port accounts for 12% of India's iron ore exports. However, according to an injunction from the Hon'ble High Court, ore handling is now halted. The oil refinery expansion of the CPCL in the hinterland is supported by the specialised facility. Suezmax ships may be handled at this oil facility.

There are presently three docks, 24 berths, with draughts ranging from 5.5 to 16.5 metres at the port. The port of Chennai does not have a natural harbour. Petroleum products, fertilisers, iron ore, and miscellaneous freight are the principal items handled. In a 50-hectare area near the ocean, an artificial port has been built. As it is a manmade port known as an artificial port. The port was the site of the country's first dedicated container terminal facility, which was inaugurated by then-Prime Minister Smt.Indira Gandhi on December 18, 1983. This terminal was privatised by the Port and is now run by M/s. D.P.World (Chennai Container Terminal Private Limited). The port is one of the world's top 100 container ports. Following a year of exceptional growth in container handling, M/s. PSA (Chennai International Terminals Private Limited) opened the Second Container Terminal in 2009, with a capacity of 1.5 million TEUs, to accommodate the growing demand.

3.1 Mission

- Achieve excellence in Port operations with state of Art Technologies
- Enhance competence and enthuse workforce to maximize customer satisfaction
- Anticipate and adapt to the changing global scenario
- Act as a catalyst for sustained development of the region

3.2 Vision

- To be recognized as a futuristic port with foresight

3.3 Quality policy at Chennai port trust

- Provide efficient, prompt, safe, and timely services at optimum cost,
- Ensure quick turn round of vessels by providing facilities for efficient handling of cargo,
- Maintain total transparency in all our transactions,

- Continually improve our services to meet the expectations of the port users, employees, and society.

3.4 Chennai port objectives

- To be India's most favoured port, ensuring environmental protection

3.5 Location

Latitude	-	13 06 N
Longitude	-	80 18 E
Climate	-	Tropical
Time	-	+5 Hrs. 30 Minutes
Temperature	-	24 C Min. 33 C Max.
Annual Rainfall	-	About 125cms.
Spring Tides	-	1.2 Metres
Water Area	-	420.00 acres (169.97 hectares)
Land Area	-	586.96 acres (237.54 hectares)

3.6 Commercial advantages of Chennai port trust

- Chennai Port is open 24 hours a day, seven days a week, to allow greater export and import through the Chennai Port.
- The Port also holds port users meetings on a regular basis to improve customer happiness and increase exports by maintaining effective service quality.
- Private equipment is permitted in some operational zones in order to speed up the loading and unloading of dry bulk shipments.
- F.C. VAIGAI Heavy Lifting Carnages (50%) If the cargo is transported using the vessel's own cranes, no charges are required up to 15 tonnes in weight.
- For all sorts of cargoes, a stevedoring charge of 192 percent of real earnings is imposed.
- The C&F levy on bulk shipments, ore, and timeber logs has been cut to $3.75 per MT.
- When real labor deployment for C & F activities is present, the C & F Levy will be collected via Import Application.

- Even when compared to the Terminal Handling Charges collected in Regional Ports such as Colombo and Singapore, the terminal handling charges at Chennai Port's Container Terminal are fairly affordable.
- The Port permits 30 free days for containers committed to and from inland container depots, including SUNDAYS and Port holidays, and it is free up to the date of loading on flats for ICD, NEW DELHI.
- Transhipment containers have a 30-day grace period.

3.7 Facilities for Exporters

- This has a substantial impact on the Port's performance, positioning it as a leader in export performance, with the following benefits for Port Users:
- Chennai Port has embraced the idea of one window clearance, and an Export Documentation Centre, which houses Customs, Chennai Clearing and Forwarding, Dock Labor Board, and other services, is housed within the port complex.
- Wharfage is discounted by 10% for palletized goods, and the weight of the pallet is not taken into consideration when calculating wharfage.
- Before the arrival of the vessel, 30 days of free day time is allocated for aggregating the export cargo on the quay.
- On a rental basis, open space in the transit area is made available for export goods such as barytes and quartz.
- Demurrage for export items left in transit shed for more than 30 days is levied at a minimum flat rate of Rs.3 per wharfage unit per day or portion thereof. Heavy lift costs on raw granite blocks are waived entirely.
- Preferential space allocation for export cargo storage
- The export promotional wharfage rate on an ad valorem basis is merely 0.3 percent of FOB value for motor vehicles, jeeps, and vans utilising the Ro-Ro system.
- Export-oriented boats are given priority berthing at the Chennai Port. In addition, the priority berth reservation scheme, which was approved by the government and allows vessels to berth on arrival for a berth reservation FEE, is gaining popularity among the trade.
- A Senior Traffic Officer has been re-designated as the Export Promotion Cell Officer to work with the high power committee established to address exporter issues.

- There are 11 Container Freight Stations operating outside the port area but within the city limit, with authorisation from the Commissioner of Customs, to meet the entire stuffing demand of export goods in containers. Some types of cargo can also be house stuffed, according to Customs.
- Almost all export FCL containers are packed outside the port, and loaded containers are transported to the terminal for transportation.
- Only Less than Container Load (LCL) export goods are crammed within the port, which has a highly modern export container freight station with on wheel loading capabilities.
- Granite blocks can be shipped directly to customers.
- Export cargo that is shut out by the ship due to an act of God, such as a cyclone or vessel grounding, is given two working days as additional free days following the completion of the vessel's taking in of export cargo.
- There are no demurrage charges on goods that has been put into a container for export and is sitting in a container terminal. Only storage fees are charged.
- Export boats are granted priority berthing (one vessel at a time)

3.8 Facilities for importer

- All Board Holidays, excluding Board Closed Holidays and Sundays, have Import Counters available for filing Import Applications.
- CRANAGE has been decreased on Heavy Lift Packages.
- Charges for storage on abandoned fcl container are limited to 2 months.
- In the event that the Trust is unable to provide Mechanical Equipment, private equipment may be used.
- For dry bulk cargoes, weighting is not required at all.
- Additional free days are granted from the date of receipt of the inquiry until the parcel is traced out and informed if the port is unable to track the package at the time of delivery due to congestion, poor sorting, or erroneous tally.

3.9 Infrastructure

- Oil Terminals at Bharati Dock (BD-I) & (BD -III)
- BD -I can handle tankers up to 160,000 DWT

- BD -III can handle tankers up to 140,000 DWT
- Installed with 5 Marine Loading Arms at BD - I and 6 Marine Loading Arms at BD - III.
- Berths laid with 762 mm (30") dia(diameter) pipelines for conveying Crude, 500 mm (20") dia pipeline for conveying White Oil Product, and 350 mm (14") dia pipelines for conveying Furnace Oil.
- Separate Pipelines installed for Crude, Furnace Oil, White Oil Products, DE ballasting, Tower Monitor, Fire Hydrant and Fresh Water
- Service Lines for LDO Bunker, Furnace Oil Bunker, and Lubricant Oil Bunker
- The facilities include pumping at the rate of 3000 Tonnes per hour for Crude oil and 1000 Tonnes per hour for Petroleum Products.
- Provision of Oil reception facilities under MARPOL convention for receiving oily ballast, sludge, and slop.
- Both the jetties are equipped with fire monitors
- There is a separate firefighting pump house with diesel and electrically driven pumps to supply fire hydrant and tower monitors**.**

3.10 Connectivity

Road Connectivity

Popularly known as "Gateway to South India", Chennai is well connected to other major cities through national highways. It is connected to Kolkata through NH 5, to Mumbai through NH 4, and to Kanyakumari through NH 45.

Rail Connectivity

Chennai Port is well connected with the national railway network. The Port is linked to the Southern Railway network through Chennai Beach Railway Station which connects Chennai Port to Southern parts of Tamil Nadu and through Royapuram Station which connects the Southern Railway Trunkline to Kolkata, New Delhi, Bangalore, Coimbatore, etc. The Port also has an internal rail network of about 70 km.

3.11 Corporate Social Responsibility

- As much as 5 percent of the total profit of Chennai Port Trust will be spent towards corporate social responsibility to uplift the lives of those living in the neighborhood of the port.
- A painting competition was organized by Chennai Port as part of the CSR initiative.
- As part of CSR implementation, five government schools in the port's vicinity were identified for grants of meritorious scholarships to students in SSLC and HSC rank holders of the respective schools.
- A scheme for the planting of 5,000 saplings as part of a project to green the port.

Welfare Activities

Several welfare activities have been taken up by Chennai Port Trust. A few of them are as follows:

- A community hall has been constructed named after **THIRU. V SELVARAJ IAS.** It has been allotted for retired deceased/retired employee's relative's viz. spouse etc... to use at a nominal charge.
- The Trust has contributed a sum of Rs.2,92,08,662/- for the year 2010-11 for the management of the Madras Port and Dock Educational Trust Higher Secondary School.

- A Welfare Committee consisting of 15 members was formed to take care of efficient and orderly maintenance of the Tondiarpet Housing Colony to promote co-operation, cleanliness, peace, amity, and cordiality among the residents of the Colony.

- Babu Jag Jeevan Ram Sports Complex is being allotted to Schools / Colleges to enable them to conduct their Sports Meet at a nominal charge of Rs.1000/- per day. Other Institutions like Clubs / Associations etc. are being permitted to utilize the stadium for Rs.2000/- per day.

- Gym for Men as well as a Gym for Women and a Yoga Centre have been established in the Tondiarpet Housing Colony.

- A Ritual Shed has been constructed at Tondiarpet Housing Colony for the allotment of the residents of the Tondiarpet Housing Colony and other employees at a nominal rent of Rs.1/- per day to enable them to perform rituals without incurring expenses.

- A library is also functioning in the Staff Institute to promote reading habits among the staff of the employees so that they can be aware of the daily news of the country and the world.

3.12 Performance and Quality Assessment

General

The total cargo handled through the existing facilities, during the past 4 years is presented in the following Table

Average Ship Berth day Output - In Tonnes

Commodity	2018 - 2019	2019-2020	2020 - 2021	2021-2022 (upto November 2021)
Liquid Bulk	14815	16203	14907	14605
Dry Bulk	11534	9214	10166	7094
Break Bulk	2855	3247	3029	2429
Containers	36064	36735	29889	31024
Overall	17288	16470	15928	15559

Vessels Handled In Numbers

Commodity	2018-2019	2019-2020	2020-2021	2021-22 (upto November 2021)
Liquid Bulk	478	430	385	260
Dry Bulk	120	88	87	44
Break Bulk	325	352	239	158
Containers	683	594	604	476
Total	1606	1464	1315	938

Average Turnaround Time of Vessels Cargo wise (In Hours)

Commodity	2018-2019			2019-2020			2020-2021			2021-2022 (upto November 2021)		
	Port A/c	Non Port A/c	Over All	Port Port A/c	Non Port A/c	Over All	Port Port A/c	Non Port A/c	Over All	Port A/c	Non Port A/c	Over All
Liquid Bulk	44.14	7.78	51.92	44.47	7.83	52.30	38.66	11.07	49.73	41.62	10.82	52.44
Dry Bulk	69.59	11.31	80.90	56.41	10.91	67.32	76.14	15.44	91.58	80.05	26.58	106.63
Break Bulk	47.26	14.50	61.76	53.17	14.71	67.88	61.19	17.83	79.02	71.61	24.55	96.16
Containers	27.70	3.85	31.55	26.00	4.44	30.44	30.21	6.76	36.97	28.56	6.20	34.76
Overall	39.68	7.73	47.41	39.79	8.29	48.08	41.35	10.61	51.96	41.85	11.53	53.38

3.13 Phases of Development

General

To meet traffic needs, Chennai Port has lately taken moves to enhance its terminal facilities. Development of a Coastal Terminal near the Northern Sheltering Arm; Construction of a Coastal Road with sufficient beach protection along the seashore to the ancient port entrance; and Two Exim Godowns to improve the stacking capability of EXIM cargo are among the current projects (Agri and Foodgrains).

Development of Coastal Terminal near Northern Sheltering Arm

Given the growing demand for coastal shipping and Chennai Port's strategic position on the country's maritime map, the port has begun construction of a Coastal Terminal near the northern sheltering arm of Ambedkar Dock, which will be outside of the port's customs bonded area. The Coastal Terminal will be a piled structure with a length of 260 metres and a width of 16 to 19.5 metres.

Construction of Coastal Road along the Sea Shore

- The Harbour Trust has carried out work of formation on a coastal road with the necessary coastal defense from INS Adyar on the eastern outskirts to the old harbor entrance to facilitate the evacuation of shores beyond the custom bonded district.

- A reinforced concrete path of 850 meters was created from the northern tower of the old harbor entrance during the construction of a mound ruin to the east of the East Quay in 2008.
- The port has no access to breakwater or re-work on the East Quay for urgent refurbishment or repair work in the gap of an access road in the area between M/s Suraj Agro- Industries and the old harbor entrance;
- Port staff and cars must then go through the area rented to the Second Container Terminal Operator, M/s CITPL with the Licensee's permission.
- Due to instability of the shore area at left out a portion of coastal road, it is proposed to provide two-lane traffic (8 m width) after adequately strengthening the existing revetment along the eastern side of the M/s CITPL compound from M/s Suraj Agro Industries to Old Harbour Entrance.

Two Numbers of EXIM Godowns

- To enhance the stacking facility for EXIM cargo (Agri & Food grains) inside the port, it is proposed to construct 2 no. EXIM godown of size 150 m × 30 m with a total area of 9,000sq.m.
- The estimated cost of the work is Rs.17.57 crores

3.14 Traffic Projections

General

Chennai Harbour is one of the country's main ports in the South. It handles over 50 MTPA of traffic and is strategically and well linked to Tamil Nadu, Southern Andhra, and Southern Karnataka by train or track. The port is also one of the country's largest container ports with over 1.5 MTEUs across both terminals. The port handles large quantities of POL, limestone, steel, and dolomite along with containers.

Major Commodities and their Projections

Containers

- The port handles roughly 1.55 MTEUs with an export-import balanced slightly tilted towards import (55%).
- The key hinterlands that the port serves for containers are Chennai and close by SEZs, Bangalore, Southern AP, and parts of Southern Tamil Nadu.

- A large portion of the traffic (50-60%) is transhipped from the port to other ports in South East Asia like Colombo and Singapore.
- We expect a large share of volumes to be removed from Chennai as we look into the future by expanding new ports near Chennai such as Krishnapatnam, Katupalli and by developing Ennore container terminals.
- The port is expected to cater to the traffic of roughly 0.9 meters by 2020, 1.2- 1.4 MTEUs by 2025, and 2.0-2.4 MTEUs by 2035.

POL (Products of Liquid)

- The port handles 12.7 MTPA of POL and is ~10.2 MTPA for the neighboring CPCL Manali refinery. This includes oil imports.
- The port also exports about 1 MTPA for goods from the same refinery to cater to particular requirements for the Chennai cluster, receiving approximately 1.5 MTPA for products.
- We expect a modest rise in crude imports to about ~11 MTPA by 2025, as refineries operate near capacity due to the domestic demand.
- Moreover, in the next few years, most coastal commodity traffic will decline.
- The reason is that the product traffic might migrate to Ennore as OMCs shifted their devices there.

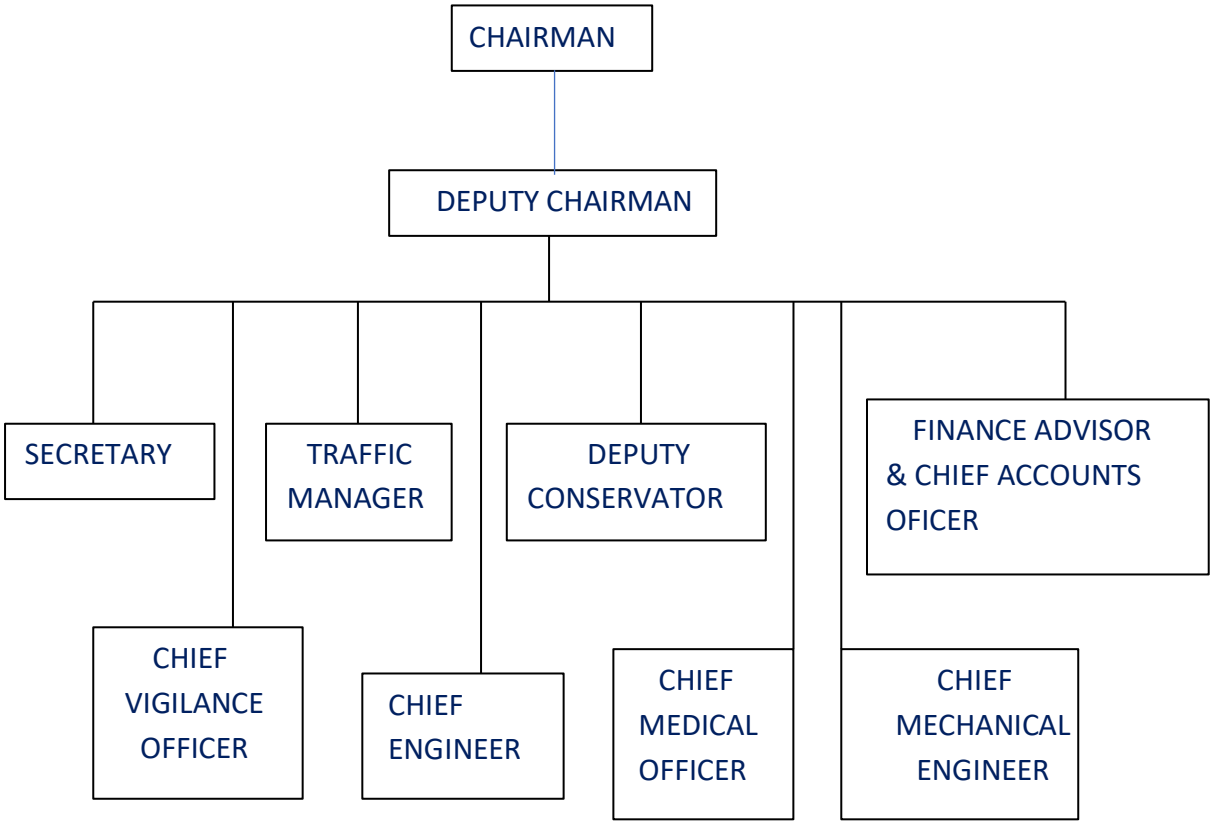
Steel

- In terms of export and import, the port present handles 1.4 MTPA of 50-50 shares of steel.
- The imports are made available to the growing car industry near the harbor.
- The total quantity of steel processed at the port is expected to increase to 2 MTPA in 2020, about 2-3 MTPA in 2025, and about 3-5 MTPA in 2035.

Limestone

- The port also imports large quantities of limestone into the Chennai district to supply the cement industry.
- The current limestone volume of the port is approximately 2.6 MTPA

3.15 Organizational Structure at Chennai Port



Departments of Chennai Port

- General Administration Department
- Finance Department
- Traffic Department
- Marine Department
- Civil Engineering Department
- Electrical and Mechanical Engineering Department &
- Medical Department
- Vigilance Department

CHAPTER 4

GREEN PORT PRACTICES OF CHENNAI PORT TRUST

4.1 Air pollution management

The dust from traffic, site clearance, rock extraction, and building activities exacerbates the air quality issue, which is a key port externality. Similarly, ambient air emissions (pollutants) from port traffic and operations include sulphur oxides (SOx), nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and volatile organic components (VOCs) (VOC). Air pollution at ports has both environmental and social consequences. Ocean acidification is one of the environmental consequences. They have a negative impact on the health of personnel and local populations, causing respiratory disorders (asthma), cardiovascular disease, lung cancer, early mortality, and birth deformities.

As a result, ports can take steps to reduce air pollution by reducing ambient air emissions and limiting and reducing dust and smell. This reduces environmental externalities while also reducing social externalities. The measures apply to all port-related operations, as well as maritime and land transportation. Although certain air pollution reduction initiatives may offer co-benefits in terms of reducing GHG emissions, particular GHG emission mitigation methods should be handled separately under the climate change mitigation and adaptation activity.

4.2 Water pollution and waste management

Ports and marine access points are usually located near towns, natural ecosystems, and animals. Port operations and related supply chain activities have a wide range of consequences. Ships' oil spills, ballast water, cargo residue, and waste disposal can pollute the sea, harming beaches and soils while endangering marine ecosystems and animals. Shipping ballast waters carry alien species into national waters, which can have a detrimental influence on marine ecosystem health, decimate indigenous species, and result in an ecological imbalance, as well as have significant health and economic consequences. Even sewage from ships, if discharged into the sea within port regions, can cause skin ailments and have an influence on the undersea ecosystem and habitats. As a result, ports can avoid and minimise effluent discharge and water contamination while maintaining standard water quality. Controlling, preventing, and monitoring cargo and oil spills during loading, unloading, and disconnection of pipes (liquid

bulk ships), as well as engine oil and lubricants, are among the measures that may be done. Sewage tanks can be monitored and sealed. Because stormwater runoff from cargo handling activities can flow straight into nearby waterways, swales, storm filters, cyclonic devices, and planters can be used to improve the quality of stormwater runoff.

Regular garbage from ports must be segregated and categorised, as well as litter control systems. Ports, on the other hand, provide ballast treatment and receiving facilities (sewage treatment), as well as rubbish collection for ships. This is especially essential for cruise ships, which produce a lot of sewage and rubbish. Ports can implement floating or movable receiving facilities that can collect, categorise, and segregate different forms of ship garbage. Furthermore, ecologically friendly services (such as ship hull and propeller cleaning) can be provided, while attention should be paid to the ship's sanitary equipment standard. Liquid bulk ship spills of oil and chemicals are prevalent in and near ports. Oil spill contingency plans, in this fashion, address the steps that should be done to avoid, control, and respond to any leak.

4.3 Noise pollution management

Ports, on the other hand, provide ballast treatment and receiving facilities (sewage treatment), as well as rubbish collection for ships. This is especially essential for cruise ships, which produce a lot of sewage and rubbish. Ports can implement floating or movable receiving facilities that can collect, categorise, and segregate different forms of ship garbage. Furthermore, ecologically friendly services (such as ship hull and propeller cleaning) can be provided, while attention should be paid to the ship's sanitary equipment standard. Liquid bulk ship spills of oil and chemicals are prevalent in and near ports. Oil spill contingency plans, in this fashion, address the steps that should be done to avoid, control, and respond to any leak. Nevertheless, ports must take action. Building noise maps; zoning of noisy activities; use of standards for limiting noise and vibration from CHE and construction (e.g., isolation of forklifts, trucks, vehicles, and tugs); insulation of windows, doors, and fences; building noise barriers around the port (e.g., concrete, trees, and earthen walls); use of silent asphalt and tyres; and planning of activities on the bay Additionally, fish bubble curtains can be utilised to reduce underwater noise from dredging. Sonars, echo-sounders, robots, and hydrophones, on the other hand, can be used to monitor and characterise ship noise, particularly for ships. As a result, ports can set aside protected areas, buffer zones, and corridors to keep ships away from sensitive marine habitats. Similarly, ports can use air bubble curtain technology to absorb shipping noise and decrease steaming of ships and tugs (cavitation inception speed).

4.4 Freshwater management

Water usage at ports is considerable, particularly for operations, cleaning and washing bulk ships and yards, and providing water to high-demand cruise ships. Water conservation and freshwater resource protection can be implemented. Ports may establish targets to decrease drinking water waste, monitor water consumption and leaks, process and use waste water (on-site), recycle cleaning water for irrigation and cleaning, and gather rainfall, for example.

4.5 Marine biology conservation

Port operations, growth, and building have a significant impact on marine biodiversity. As a result, reducing, monitoring, and managing the consequences on marine biodiversity should be prioritised (flora and fauna). Ports can take steps to reduce sediment effect, eliminate dredging-related devastation, safeguard habitat quality in water and above water regions, and manage floods. Dredging projects, which deepen channels and berths to accommodate larger ships, need creative resource mitigation and stewardship (e.g., sediment management plans).

4.6 Hazardous cargo management

Ports take safeguards for hazardous cargo ships and hazardous cargo handling, such as the separation of hazardous products and building materials, and the use of qualified contractors to manage hazardous waste, in addition to obeying the International Maritime Dangerous Goods (IMDG) Code. Hazardous cargo carelessness, such as the transport of explosives and chemicals in bulk, has significant environmental consequences for society and life below the sea. Even more recently, in relation to COVID-19, sterilisation and fumigation of shipments arriving from epidemic regions has been used as a preventative strategy.

4.7 Climate change mitigation and adaptation

While ports are important links in global transportation networks, they are vulnerable to climate change due to their placement on beaches and shoreline, as well as their access points. While the effects of climate change are destructive, such as sea level rise and storm surges (cyclones, tornadoes), heavy rainfall, and increased wind speeds, ports must prepare by conducting adaptation activities and procedures in order to remain functioning. Otherwise, such consequences weaken port infrastructure and operations, resulting in increased downtime for cargo handling and clearance, as well as delays for ships and land transportation. Ports should

use steps to decrease GHG emissions (decarbonisation) in port landside operations, including energy efficiency, and promote the reduction of ships and land transport GHG emissions from a mitigation standpoint.

Ports account for 3% of worldwide GHG emissions, whereas shipping accounts for 2.89 percent. Port regions account for nearly half of all shipping-related emissions, accounting for 5% of total emissions. Shipping GHG emissions are anticipated to grow by 90–130 percent by 2050 compared to 2008 levels unless shipping and ports adopt actions to minimise emissions.

4.8 Provide alternative energy sources for docked ships

The shipping sector generates some of the dirtiest fuel on the planet. Instead of fossil fuels, ports can upgrade their infrastructure to deliver alternative fuels such as liquefied natural gas. The most recent IMO regulations already require this. Ships in port can also connect to the "electrical grid" (powered by renewable energy). This is known as onshore power supply, and it helps avoid greenhouse gas emissions and oil spills (OPS).

4.9 Utilize big data to improve efficiency

Ports throughout the world are now clogged, as ships sit idle for hours waiting to discharge goods. This results in wasteful fuel use and the possibility of oil leaks. Ports may employ big data and predictive tools to optimise vessel scheduling and reduce pile-ups as a solution. This would significantly increase port productivity, save time and money, and reduce fuel waste and pollution.

4.10 Upgrade port equipment

Port equipment is currently not developed with long-term sustainability in mind. Cranes, forklifts, and vehicles all run on diesel, adding to the industry's already large carbon footprint. These devices may be updated to run on greener, lower-emission fuels.

Other techniques to consider are:

- Implementation plans for port sustainability
- Standards and regulations
- Encouragements and disincentives

Ports may establish voluntary agreements with polluters or other social and economic forums/unions to transition to more sustainable performance without being bound by any legal responsibilities.

4.11 Training and knowledge sharing

Sustainability awareness is promoted by port authorities to their staff, port operators, and even ships and land transit. As a result, ports may offer training courses and seminars aimed at influencing trainees' behaviour toward improved sustainability action adoption. Linking port sustainability efforts and measures to the UN Sustainable Development Goals. Both port sustainability activities and measures, as well as the Sustainable Development Goals, may be seen of as accelerators for global sustainability.

4.12 Linkage with environmental actions

Many SDGs may be aided by simple environmental activities. The action and actions to reduce air pollutants, for example, serve Goal 3 (excellent health) for employees and the surrounding community.

Actions and strategies to combat water pollution and waste are critical for achieving Goal 6 and maintaining high water quality on land (clean water and sanitation). While ports manage and minimise shipping (e.g., waste receiving facilities in line with IMO MARPOL), port residue, and waste discharge to seas and oceans; life under the water benefits. The numerous conservation activities in marine biology contribute to diverse purposes.

Given that the globe has endured and continues to suffer from the effects of the COVID-19 pandemic, addressing climate change is another pressing worldwide problem (shock). In this sense, ports can adopt mitigation and adaptation steps, contributing to Goal 13 (climate actions), and once ports enhance infrastructure, they contribute to Goal 9 (innovative infrastructure) and Goal 11 (sustainable development) (sustainable cites). Developing effective hinterland and intermodal linkages has a comparable effect. Reduced GHG emissions, such as through electrification and onshore power generation, also helps to prevent ocean acidification and underwater noise (Goal 14). Energy efficiency measures reduce energy consumption (Goal 12 responsible consumption), increase access to renewable energy sources such as wind, solar, ocean, and geothermal energy (Goal 7 clean energy), and boost profitability, all of which contribute to Goal 8 (economic growth) and Goal 1 (sustainable development) (reduction of poverty). Reduced congestion in and around the port, as well as improved cargo and employee

mobility, are examples of actions that contribute to city and community sustainability (Goal 11), as well as improved health by lowering accidents and ambient air pollutants (Goal 3).

Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs)

	SDG 1 No Poverty	SDG 2 No Hunger	SDG 3 Good Health	SDG 4 Quality Education	SDG 5 Gender Equality	SDG 6 Clean Water	SDG 7 Renewable Energy	SDG 8 Economic Growth	SDG 9 Innovation Infrastructure	SDG 10 Reduced Inequalities	SDG 11 Sustainable Cities	SDG 12 Responsible Consumption	SDG 13 Climate Action	SDG 14 Life Below Water	SDG 15 Life on Land	SDG 16 Peace and Justice	SDG 17 Partnerships
Air pollution			⊘						⊘		⊖		⊖	⊖	⊖		
Water pollution and waste	⊖					⊘		⊖						⊘	⊘		
Noise pollution			⊘					⊖						⊘	⊖		
Visual pollution			⊘						⊘		⊘						
Fresh water						⊘											
Marine biology conservation	⊖					⊘								⊘	⊘		
Hazardous cargo			⊘					⊘			⊘			⊘	⊘	⊘	
Circular economy			⊖			⊖		⊘		⊘		⊘	⊖	⊖	⊖		
Climate change	⊖		⊘				⊘		⊘		⊘	⊖	⊘	⊖	⊖	⊖	⊖
Employees rights	⊘		⊘	⊘	⊘			⊘		⊘						⊖	⊖
Safety and security			⊘								⊘			⊖	⊖	⊘	
Community			⊘	⊘													⊘
Seafarers			⊘							⊘						⊖	⊘
Economic growth	⊘	⊖						⊘	⊘			⊘					⊘
Trade and logistics facilitation			⊖					⊘	⊘			⊘	⊘		⊖		⊘
Digitalisation			⊘						⊘							⊘	⊘

⊘ potential direct association ⊖ potential indirect association

CHAPTER 5

SUGGESTIONS AND CONCLUSION

Green agenda:

Greentech for Ports & Terminals 2021, focused on the deployment and funding of sustainable solutions, as well as the collaboration needed to enable industry-wide decarbonisation progress. Green initiatives and energy-saving methods need a substantial investment.

5.1 SUGGESTIONS:

1. Collaboration

   According to the IMO objective, marine industry companies must cut their emissions by 40% by 2030. This objective will necessitate collaboration between ports, terminals, and shipping lines in ways that have historically been seen as incompatible with the competitive market environment in maritime.

2. electrification: ousting diesel for a more sustainable alternative

   Find out how port operations may be electrified, from large-scale container handling equipment to electric cars and other technologies, to drastically cut C02 and greenhouse gas emissions. This seminar will look at how ports and terminals may make well-informed decisions about switching away from diesel.

3. port expansion and infrastructure investments

   Ports may help fund large-scale projects that have a big influence on the energy landscape and use renewable energy sources. One of the most significant expenditures for port stakeholders is infrastructure.

4. Emerging technology

   When it comes to efficiency and constant operational improvement at ports and terminals, emerging technologies like AI, machine learning, and other emerging technologies generate a lot of talk.

5. Alternative fuels

   Alternative fuels have a lot of promise, but finding a replacement for diesel isn't easy, especially with so many competing technologies like LNG, hydrogen, ammonia, and even next-generation diesel.

5.2 CONCLUSION

The Chennai Port Trust intends to construct a marina along a 200-meter (660-foot) section of the west quay that will be able to accommodate a dozen boats. These sailors, who arrive on tiny boats, will be provided with lockers, segregated berths, and other amenities by the marina. After that, the sailors can go sightseeing inland. The idea, though, is still on paper. Although a proposal to develop a large-scale marina is in the works, the port will not be able to have one until the coal yard is decommissioned. Following the removal of coal handling, the port will reclaim land by building groynes, which are stiff hydraulic structures erected from an ocean beach that disrupt water flow and impede silt transport. The port has planned to invest 493.1 million in a 7.5 MW wind energy project in Tirunelveli district. To relieve congestion at the harbour, which has two bays (two each for container entrance and leave), the port proposes to modernise zero gate and create one more bay, as well as enlarge the roads leading to zero gate and build six to eight lanes from zero gate to minimise car stranding.

In December 2011, the Directorate of Logistics, Customs, and Central Excise announced plans to install a fixed mega container scanner outside the port's Zero Gate for a cost of 600 million from a US-based business as part of security measures.

The Chennai Port Trust proposes to build a barge handling facility at Bharathi Dock for 260 million dollars as part of a public-private partnership to address rising demand for bunkering the fuel oil used aboard ships. The demand for a barge facility is also driven by the growing number of vessel movements and sizes. The jetty's intended length will be three times that of the current facilities.

Barges having a carrying capacity of 1,000 to 3,000 tonnes may dock at the jetty. Other commodities that are expected to be handled at the proposed facility include vegetable oil (crude and refined), furnace oil, and molasses, in addition to bunkering fuel and edible oil.

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