"A study of factors affecting Turnaround time of Container terminal in Indian Major Ports."

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

By

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Reg. No. 2003305015

MASTER OF BUSINESS ADMINISTRATION

(International Transportation and Logistics Management)

School of Maritime Management

Indian Maritime University

Chennai Campus.

Under Guidance Of

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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.

-Gatate Ganesh Vaijeenath

Declaration

I, **Gatate Ganesh Vaijeenath** (Reg. No 2003305015), 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. Lekha Ravi**, 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 **Gatate Ganesh Vaijeenath**

Date: May 2022 **2003305015**

Certificate

Indian Maritime University, Chennai.

This is to certify that the project report entitled "A study of factors affecting Turnaround time of Container terminal in Indian Major Ports.", submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus., in partial fulfillment for the award of the degree of Master of Business Administration in International Transportation and Logistics Management, is a record of work carried out entirely by Gatate Ganesh Vaijeenath, Reg. No. 2003305015.

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ABBREVIATIONS

Following are some general abbreviations used in the industry.

AAPA	American Association of Port Authorities
ABP	Association of British Ports
ADB	Asian Development Bank
AQCS	Animal Quarantine and Certification Services
ATA	Actual Time of Arrival
ATB	Actual Time of Berthing
ATC	Actual Time of Completion
ATS	Actual Time of Sailing
BAP	Berth Allocation Problem
BOT	Build Operate Transfer
BT	Berthing Time
CAGR	Cumulative Annual Growth Rate
CBIC	Central Board of Indirect taxes and Customs
CDRUG	Drug Controller
CICT	Colombo International Container Terminal DCM
DC	Dangerous Cargo
DCT	Dual Cycling Technique
DEA	Data Envelopment Analysis
DFT	Department for Transport
DT	Detention Times
DWT	Dead Weight Tonnage
FDI	Foreign Direct Investment
FSSAI	Food Safety and Standards Authority of India
GCA	Generalized Cost Approach
GCP	Gross Crane Productivity
GDP	Gross Domestic Product
ICD	Inland Container Depot
ICS	International Chamber of Shipping
IM	Inward Movement
IMO	International Maritime Organization

ISO	International Organization for Standardization
ISPS	International Ship and Port Security
ITT	Inter Terminal Trucking
JCT	Jaya Container Terminal
JNPT	Jawaharlal Nehru Port Trust
KDS	Kolkata Dock System
KPT	Kolkata Port Trust
LOA	Length Over All
LPG	Liquefied Petroleum Gas
MMD	Mercantile Marine Department
MRPL	Mangalore Refinery and Petrochemical Limited
MTPA	Million Tons Per Annum
NH	National Highway
NLEA	Nested Loop based Evolutionary Algorithm
NMDP	National Maritime Development Program
NMPT	New Mangalore Port Trust
NWTB	Nonworking Time at Berth
OBT	Out Bound Carrier
OM	Outward Movement
OOCL	Orient Overseas Container Line
OOG	Out Of Gauge
OSBD	Output per Ship Berth Day
PBM	Parametric Bootstrapping Model
PBWT	Pre Berthing Waiting Time
PGA	Partner Government Agencies.
PHO	Port Health Officer
POD	Port of Discharge
POL	Petroleum Oil Liquid
PPI	Port Performance Indicator
PPP	Public Private Partnership
PQIS	Plant Quarantine Information System
PUI	Port Utilization Indicators
QCAP	Quay Crane Assignment Problem
QGC	Quay Gantry Crane

RTG	Rubber Tyred Gantry Crane
SAGT	South Asia Gateway Terminals
SEZ	Special Economic Zone
ST	Service Time
TEU	Twenty foot Equivalent Unit
TEU	Twenty-foot Equivalent Unit
TLSP	Total Logistical Service Providers
TRT	Turnaround Time
TSA	Terminal Service Agreement
UNCTAD	United Nations Conference on Trade and Development
UNCTAD	United Nations Conference on Trade and Development
UPCL	Udupi Power Corporation Limited
USD	United States Dollar
VAL	Value Added Logistics
VLCC	Very Large Crude Carriers
VTMS	Vessel Traffic Management System
VTRT	Vessel Turnaround Time
VTRTO	Vessel Turnaround Time Optimization
VTT	Vessel Turnaround Time
WCCB	Wild Life Crime Control Bureau
WCT	Work Commenced Time

Chapter 1

Introduction

The Globalization and the removal of barriers to trade between the various countries have resulted in a dramatic increase in maritime transport. This growth was the result changes in both the trading pattern and the structure of the asset. Large amount of cargo is moved from one place to another by mode of sea transport because of its cost effectiveness. The change in trading pattern has made a difference of the new generation and sophisticated vessels to enable the transfer of fast-moving, consistent and inexpensive commodities. With the advent of the latest model and ship size, there is a need for additional port infrastructure and improved service quality to bring it back to promote international trade (Michel and Noble, 2008).

Thus, there is high competition among port authorities to attract shippers. Increase productivity as well the performance of their terminals, port managers will need to consider the minimum time to change ships calling to port. Time to change the ship in ports that demonstrate the terminology of port termination in the provision of efficiency services. Current research is intended to identify the underlying issues extending shipping time in the Indian port sector and providing affordable and efficient services with high port productivity. It is also intended to achieve the efficiency of the port in the major ports of India.

Maritime transportation is considered as the main mode of transportation in international trade due to its ability in facilitating high-volume low-cost transportation capability. Proving the fact, as per International Maritime Organization (IMO), maritime transportation accounts for 90% of international trade by volume and 70% by value with a commercial vessel fleet of 1.86 billion Dead-Weight-Tons (DWT). This derived demand is catered by over 50,000 cargo vessels owned by shipping lines or individual

ship owners which are registered in over 150 Flag States and manned by over one million sea fearers from all over the world, highlighting the international nature of the business. A few decades ago, ports were primarily used as a link between land and sea, where they were primarily responsible for basic cargo handling and vessel shelter. Yet, looking at the current scenario, their contemporary role has changed to a new role of Total Logistical Service Providers (TLSP) in vast supply chain networks, thus they are no longer seen in their traditional view.

Today, ports' customers cannot be satisfied with handling of their precious cargo as they have many expectations mainly including consistent and reliable services, high performance in cargo handling operations, on-arrival berthing or dedicated berths for vessels, competitive rates and rebates on performance commitments (Volume Commitments, Performa Maintenance, etc.) and so on.

Indian Major Ports

There are 12 major ports in India. Most of them have to deal with many deficiencies like low connectivity with the hinterland and insufficient port infrastructure. The policy of privatization of these government-owned ports have opened up larger prospects for expansion and improvements. The assessment of productivity and efficiency of the major ports is very much required when the reform process has to be allowed by private participation.

The lack of research work in the area of port productivity and efficiency caused in the poor evaluation of the level of performance by the Indian ports. The economic reforms of the Indian government by the industrial policy 1991 gave new direction and status to the port reform process. In India, the economic reforms started late compared to the world economic growth.

But there are many positive features in the financial operation in the post transformation phase. To assist long duration developments of the economy with fool proof technique, the reform process is essential. Therefore, it is vital to have legal and regulatory systems to back up the privatization process. Even though the reform process was started during early 1991, it needed a long period for the government to implement the same in the various economical segments.

The Government of India is aimed to have a robust strategy frame work to extend the reform process to different segments of the economy over some time. The government-owned ports are opened for private participation during 1995- 1996(Maritime Agenda-2020, 2011). The selected areas of port activities like terminal operation, berth operation, cargo handling, dredging, stevedoring, providing the tug operation, maintenance of existing yards and sheds, etc., are allowed to private sector participation.

The private participation is allowed through a competitive tendering process with Public Private Partnership (PPP) mode and Build Own Operate and Transfer (BOOT) mode contracts for a 15 to 30 years concession agreement. The sole purpose of privatization of operations at major ports of India is to improve the performance efficiency, cost reduction, and capacity augmentation. To achieve this authority of the port management are vested with operational autonomy and made accountable for completive business with sustainable port efficiency. Due to this reform process, many of the port terminals are equipped with sophisticated port equipment, development of new captive berths/jetties and up gradation of existing infrastructures.

The implementation of the latest technology in cargo handling, loading, and unloading, improved port infrastructure enabled the major ports with improved ability of cargo handling. Thus, the efficiency and productivity are also increased due to reforms and private participation.

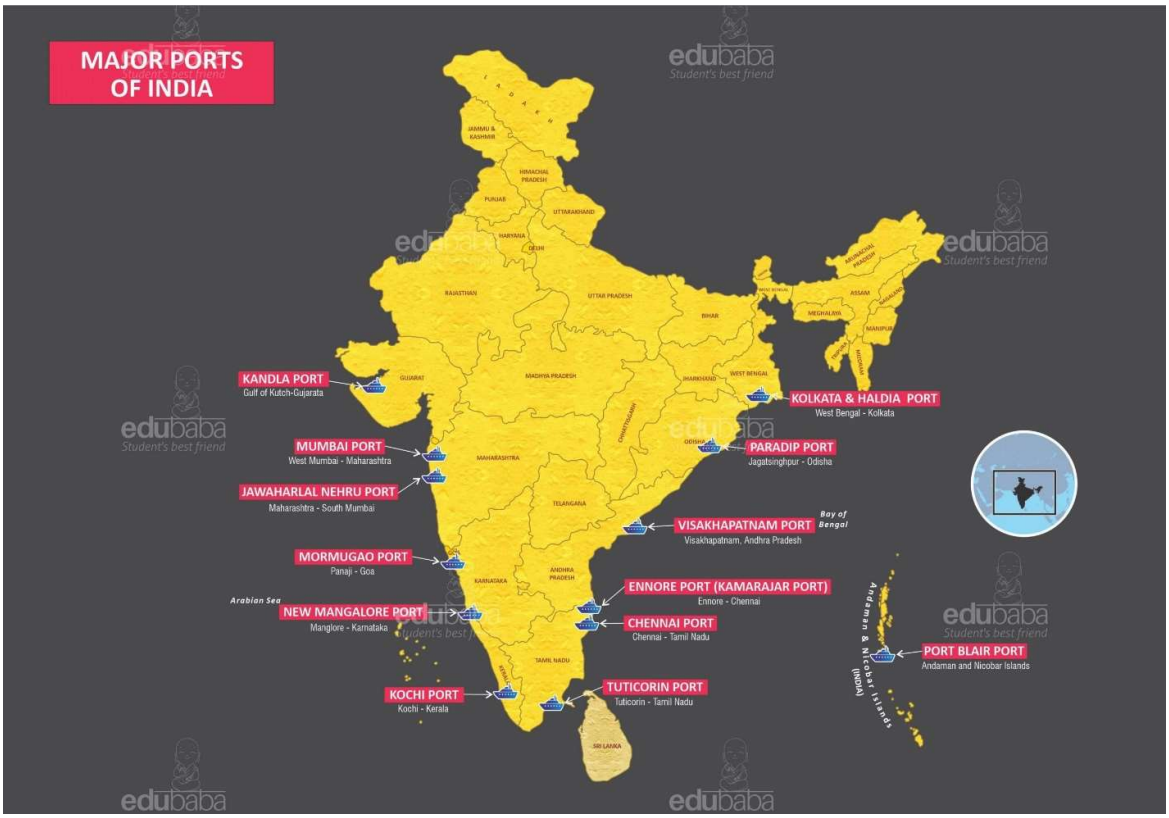

Fig. Major ports of India (Source : https://edubaba.in/major-ports-of-india/[1])

Container Trade

Container trade brought about a revolution in the transport industry and lots of impact on the transport industry and port sector has begun to face a change after the emergence of containerisation. The transport chain network is giving rise to significant economies, the containers permit a freight to be transported more cheaply and further than ever before in the market. Containerisation has given a transferability in the port changes as it gives them a shipping lines much greater freedom to serve the markets from a wider choice of ports. Markets that were once seen as an exclusive hinterland of a particular port can now be served as by many gateways. The individual ports no longer have the exclusive control over the inland markets, and they can no longer be sure that the trade in their local regions

[1] https://edubaba.in/major-ports-of-india/

can be secure. The impact of containerisation has brought lot of changes in the port industry, the transportation sector and the logistics divisions.

The port industry has taken significant measures to make the containerisation successful and investments on the containerisation made the containerisation an important entity in the transport industry. The investments like purchasing the gantry cranes, developing an ever-larger terminal sites, and investing in a wide range of mechanised yard equipment to speed dockside and yard operations. These investments are carried out by port industry. The result shows a significant reduction in the terminal costs and improvements in the efficiency, benefits that have been shared throughout the transportation chain system for the containerised sector. Thus, the port industry has and have to borne a large share of the investment burden on containerisation without a proportionate share of the benefits. Container vessel operation is mainly characterized by fixed schedules and fixed port of calls.

Major international container carriers follow tight sailing schedules with minimum sailing times from port-to-port while expecting quicker cargo handling times at ports, thus the performances of terminals determine the overall effectiveness of shipping lines. Number of container moves handled per hour is used as a measure of calculating productivity at terminals as it leads to determine Turnaround Time (TT) for vessels. In general scenario, higher the productivity – lesser the turnaround time where the Vessel Turnaround Time (VTT) is defined as a summation of all waiting times, idle times and container handling times at ports.

Time is money; specially in shipping industry. Ship owners and international shipping lines expect faster operations at ports to achieve shorter Vessel Turnaround Times (VTT), thus leading to low costs while increasing higher number of load trips per year.

An average size container vessel was assumed to be spent around 60% of its time at berths with a daily cost of $65000 in year 2000. Looking at the contemporary scenario this figure is much higher for a present-day mega carrier, thus shipping lines are not in a position to lose the time and the money in ports that their vessels saved at sea. As such, it is unavoidable that port operations are going to be seen as bottlenecks in complex supply chain networks while urging the shipping lines to move towards invest in terminal operations to secure better and quicker performances for their vessels. From another view, terminals are mainly operated either as "Dedicated Terminals" or as "Multi User Terminals" based on their ownership, type of operation and key customer basis.

The Multi User Container Terminals are commonly characterized by state ownership nature where berths are allocated "First Come First Served" basis subject to Terminal Service Agreements (TSAs) and berth restrictions. As such, berths, quay cranes and other machineries are allocated to a vessel considering its time of arrival and availability of terminal resources, unless specifically requested. Container terminals are operating in a very competitive environment where they are continuously competing with each other to retain their existing customers despite of attracting new businesses to their terminals.

The competition is so intense, such that, it is believed once a shipping line decides to divert its vessels from a terminal to another, it is almost gone forever for that respective terminal (port). Looking at the history, European Ports were ranked as the busiest container ports few decades ago. However, considering the present scenario it can be seen that this concentration has shifted towards Asian region with its fast-developing economies, including China, India, Malaysia and Singapore etc (Jinxing et al. 2010).

Turnaround Time

Turnaround time is one of the essential key performance indicators (KPIs) in port logistics. Shorter turnaround time is economically viable. As it ensures quick loading and unloading processes and reduces the risk of bottleneck situations at the ports. It also saves money and resources for port terminal. In Sea transportation, the time that is taken between the arrival of a vessel and its departure is referred to as the turnaround time.

The calculation of average turnaround time (ATT) is easy to understand; it corresponds to the average difference between the date of departure and date of arrival of the vessel among all container vessels calling at a port (or country), usually within one month of navigation.

The vessel turnaround time is used to measure the efficiency of port operations. Following investments in mechanisation the container turnaround time at Indian major ports has decreased to roughly 26.5 hours, down from 45-odd hours in 2013-14, according to Union Minister for Ports, Shipping and Waterways, Shri. Sarbananda Sonowal.[2]

The Centre has brought in private companies to take up development in the sector, with an emphasis on port-led development, according to the Minister. "The turnaround time for containers at Indian ports has improved to 26.5 hours. We also do not have container backlogs, as other foreign countries do. So, I'd say we've done well as a service provi[i]der," he remarked.

India's cargo traffic at India's 12 major ports during April-March, 2020-21, decreased 4.6 per cent to 671.82 million tonnes (from 704.56 million tonnes in 2019-20) primarily due to the pandemic. However, numbers are expected to cross 700 million tonnes this fiscal with economic activity normalising.

[2] https://www.maritimegateway.com/major-ports-turnaround-time-down-at-26-5-hours/

Statement of Problem

On what basis the factors affecting the turnaround time of container terminals of major ports in India are decided and if there are any other factors that should be taken into consideration?

Objectives

1. To study how container terminals perform efficiently in Indian Ports.
2. To find how the turnaround time affects the performance of Container terminals.

Research Methodology

This study is not based on any primary data sources and relies entirely on secondary data sources. All these secondary data sources are collected from the concerns port website, news articles, journals, and review of reports done on the respective port terminals.

Limitations of the study

Limitations are the restrictive under conditions which the researcher has to carry on his work. Such restrictions are necessary and even unavoidable for the researcher to set boundaries by limiting the scope of findings.
Following are the limitations of the study

- The study is only based on secondary data
- Insufficient sample size for statistical measurements.
- Limited access to data.

This project describes the how the project will be carried out and what are the tabulation and data collected how the data are collected and used in the report for the analysis of the various container terminals.

Chapter Scheme:

The project work titled "A study of factors affecting turnaround time of container terminal in Indian major ports." has been divided into following chapters:

Chapter One introduces the topic of the project along with its objectives, research methodology, scope and limitations.

Chapter Two deals with the literature review. It is based on the secondary data such as reports, research articles, news articles published by renowned institutes.

Chapter Three includes the analysis of the data collected of container terminals efficiency and performance.

Chapter Four highlights the discussion and findings/inferences drawn from the research made so far.

Chapter Five focuses on the summary of research & findings and suggestions if any.

Chapter 2

Review of Literature

Cochin Port is one of India's largest ports. Turnaround time is an important operational statistic that reflects a port's ability to deliver improved service and productivity to its users, or shippers.

In an International Journal of Pure and Applied Mathematics written in 2017 written that Reduction of Turnaround Time for Vessels at Cochin Port Trust[ii][3]

From the study, it is being understood that the vessel turnaround time of port increased from the preceding year. Shippers are looking for the port which can provide optimum services like less turnaround time for vessels, less container damage, direct birthing and efficient customs clearance according to Turnaround time is defined as the total time between the arrival and departure of vessels divided by a total number of vessels.

Turnaround time of vessel includes the time taken to unload and load cargos/containers.

Therefore, the problem of double cycling is one of scheduling jobs, or finding the order in which to operate on the columns that minimizes ship turn-around time.

In an article published in Ideas For India on 10th June 2019 explained that How operational efficiency of India's ports impacts its manufacturing exports?[4][iii]

Since 2010, the average turnaround time of Indian ports has decreased

[3] https://acadpubl.eu/jsi/2017-117-20-22/articles/20/82.pdf

[4] https://www.ideasforindia.in/topics/trade/how-operational-efficiency-of-indias-ports-impacts-its-manufacturing-exports.html

dramatically, showing increased operational efficiency.

According to this report, if the average turnaround time could be reduced by 50%, India's manufacturing exports may improve by at least 20-25 percent.

In comparison, the growth rate in the US$ value of India's manufacturing exports from 2012-13 to 2017-18 was 8% or less (negative in two years), with an average annual growth rate of only about 3%.

However, a multi-pronged strategy aimed at significantly increasing the competitiveness of Indian manufacturing firms – focusing on innovation and technological advancement, skill formation, infrastructure development, and the provision of efficient services as an input in manufacturing, among other things may be possible. In a report by the Planning Commission, vessel turnaround time for 2010 was 46 hours in Cochin, 28 to 32 hours in Chennai, Tuticorin, and J.L. Nehru Port, and only 13 hours in Hong Kong and 14 hours in Singapore.

Finally, as previously said, a 50% reduction in average TRT in Indian ports is not an impossible goal to aim towards.

In conclusion, it has been mentioned above that a 50% cut in average TRT in Indian ports is not an unrealistic target to aim for.

Logistics insider is a magazine which covers exclusive news for Indian logistics industry, transport and supply chain published an article on 25th Feb 2021 on India's major ports improve average turnaround time, showcase increased efficiency[iv5]

Over the last six years, the average turnaround time for ships at India's 12

[5] https://www.logisticsinsider.in/indias-major-ports-improve-average-turnaround-time-showcase-increased-efficiency/

major ports has decreased by 35%.

According to the Economic survey 2020-21, the Ships' average turnaround at the country's major ports fell from 4 days in 2014-15 to 2.59 days in 2019-20.UNCTAD says that port efficiency can shape countries' trade competitiveness. As per reports, Pradip port along the eastern coast in Odisha has shown the biggest improvement in reducing the turnaround time of ships from 7 days in 2014-15 to less than 3 days.

The Indian maritime sector which includes of 12 major and 200 minor ports moves about 95 percent of India's trade by volume and 68 percent by value.

This covers port efficiency improvements, existing port capacity increase, and new port development.

On 24th Feb 2021 an article published in Money control in which it is stated that **India's average ship turnaround time at major ports improves[v6]**

Ports are considered to be the major growth engines of a country and efficient port management with faster turnaround time holds the key to a nation's economic development.

According to the Economic Survey 2020-21, which was released last month, the average turnaround time for ships at the country's major ports decreased from 4 days in 2014-15 to 2.59 days in 2019-20. According to UNCTAD data, the global median ship turnaround time is 0.97 days, indicating that India's port efficiency might be improved further, according to the Economic Survey. Maritime transport carries over 95 percent of India's commerce volume and 68 percent of its trade value. The competitiveness of countries can be shaped by port efficiency.

The Economic Times article was published on 31st January 2022 it

[6] https://www.moneycontrol.com/news/business/indias-average-ship-turnaround-time-at-major-ports-improves-6568461.html

was about Economic Survey: Average ship turnaround time at major ports down to 55.99 hrs in FY21.[vi] [7]

According to the Economic Survey 2021-22 released on Monday, the average ship turnaround time at India's major ports has decreased to 55.99 hours in 2020-21 from 62.11 hours in 2019-20 as a result of the government's various steps to increase the ease of doing business..

The government has undertaken initiatives like as those under the Sagarmala plan to improve port governance, capacity utilisation, port efficiency, and connectivity, according to the survey.

181 projects costing Rs. 94,712 crore have been completed out of 802 projects worth Rs. 5.54 lakh crore under the Sagarmala plan, while 223 projects worth Rs.2.11 lakh crore are under way.

As per the article published in Press trust of India on 28th Jan 2022, The container traffic at Jawaharlal Nehru Port Trust (JNPT) rose 25.86 per cent to 5.63 million TEUs (twenty-foot equivalent units) in the calendar year 2021

Container traffic at Jawaharlal Nehru Port Trust (JNPT) rose 25.86 per cent to 5.63 million TEUs (twenty-foot equivalent units) in the calendar year 2021, the country's premier container port operator said in a statement on Thursday.

The previous year's traffic was 4.47 million TEUs, according to the report. The total cargo traffic at the port in 2021 was 76.14 million tonnes, up 22% from 62.32 million tonnes last year, according to the report.

The total traffic and container traffic handled by JNPT in the previous calendar year were the greatest ever recorded in a calendar year since the facility's establishment, according to the company. Jawaharlal Nehru Port Container Terminal (JNPCT), NSICT, Gateway Terminals India Pvt Ltd (GTIPL), NSIGT, and Bharat Mumbai Container Terminals Pvt Ltd are among them.

[7] https://infra.economictimes.indiatimes.com/blog/economic-survey-average-ship-turnaround-time-at-major-ports-down-to-55-99-hrs-in-fy21/89244888

Money control article written by Yaruqhullah Khan on 21st April 2022, Indian ports fast-track efforts to increase cargo handling capacity[vii][8]

The country's major ports are accelerating projects to increase cargo handling capacity as they anticipate an increase in export and import traffic in the current and future fiscal years.

A vaccination not only triggers an immune response to protect people from future COVID-19 infections, but it also aids in the rapid development of herd immunity to stop the pandemic.

Vaccine development is a long, complex process. According to one source, the port authorities are hoping to meet the dates for the second and third phases of the 2016 master plan, which are set to be completed by the end of 2023-24 and 2028-29, respectively.

APSEZ has received environmental and coastal control zone clearances to increase Mundra Port's capacity to 385 million tonnes (mt) from 300 mt, and plans to finish two projects this year to extend the port's eastern and western breakwaters by 500 metres each.

On 11th May 2022 The Financial Express **published an article which will help our report by that how** Chattogram (Ctg) seaport **Improving port's capacity, efficiency.[viii][9]**

The necessity of strengthening the Chattogram (Ctg) seaport's operational capacity cannot be overstated, given the importance of the country's principal gateway for foreign trade.

In light of this, it's reassuring to see that two important gantry cranes and three Rubber-Tyred Gantry (RTG) cranes have allegedly been sent to the

[8] https://www.moneycontrol.com/news/business/indian-ports-fast-track-efforts-to-increase-cargo-handling-capacity-8391641.html

[9] https://thefinancialexpress.com.bd/home/improving-ctg-ports-capacity-efficiency-1652198834

Ctg port for installation as part of the government's strategy to buy sophisticated cargo handling equipment.But after a drastic fall in pandemic-time operation of the port, it regained its position and last year (2021) it handled more than 3.2 million TEUs of containers.

Even so, there is hardly any room for complacency. For an overall improvement of a port's efficiency involves expansion of its storage facilities, an increase in the number of berths and, of course, addition of more cargo handling equipment including cranes.

With such facilities made available, the Ctg port's potential as a regional maritime hub will no doubt increase manifold.

JNPT handled the highest ever container traffic. 5.63 million TEUs was the total quantity handled. [ix10]

In 2021, India's premier container port, the Jawaharlal Nehru Port Trust (JNPT), continued its steady increase in cargo handling, with total container traffic of 5.63 million TEUs (5,631,949 TEUs) compared to 4.47 million TEUs (4,474,878 TEUs) in 2020, a 25.86 percent increase over the previous calendar year.

Since the port's establishment, the total traffic of 76.14 million tonnes and container traffic of 5.63 million TEUs has been the most in a single year.

It also handles the most Exim cargo traffic of any Indian port. Shri Sanjay Sethi, Chairman, JNPT, thanked staff and stakeholders for their contributions to port performance, saying, "This performance during the year, despite the challenges of the pandemic, is a monument to our dedication to fostering economic growth in India.

In a pivotal step towards streamlining the rail movement of EXIM cargo,

[10] https://thefinancialexpress.com.bd/home/improving-ctg-ports-capacity-efficiency-1652198834

JNPT commenced the dwarf container train service via double-stacked dwarf containers, giving the EXIM community a competitive cost advantage by lowering hinterland logistical costs while simultaneously enhancing rail-cargo traffic at JNPT.

In an *Expert risk article* **published May 2022 the wrote about Covid, crew and congestion**[x11]

Covid- Hundreds of thousands of crew members were stuck on ships due to 19 restrictions and travel bans, some for years. Shipowners in some segments may be affected.

During March and April 2022, a number of vessels owned by ferry operator P&O Ferries were detained by UK authorities over dummy safety concerns, including crew familiarization and training. According to Justus Heinrich, Global Product Leader Marine Hull at AGCS, crew welfare and retention rate is a risk element evaluated in underwriting. "The capacity to attract and retain experienced crew is crucial, especially with more sophisticated vessels and technology."

Finally, seafarers in the Black Sea are in danger, trapped onboard vessels or in ports with decreasing supplies and under fire, which is another another blow to the business and global supply chains, given that crew levels have not yet restored to normal Ultimately, seafarers in the Black Sea are in a perilous situation, stuck onboard vessels or in ports with dwindling supplies and under fire, which is yet another blow for the industry and global supply chains, given crew levels have not yet returned to normal levels

[11] https://www.agcs.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-22-post-covid.html

Chapter 3

Analysis of the study

How container terminals perform efficiently in Indian Ports and how the turnaround time affects the performance of Container terminals.

Seaports are regions where there are amenities for berthing or anchoring of vessels. It has got centres for the transfer of shipment from deliver to shore and shore to ship or ship to deliver. It acts as an interface between ship and shore within the maritime intermodal delivery machine.

Present-day ports perform wider variety of capabilities, past the shipment operations. They act as financial multiplier for the state's prosperity via facilitating the increase of infrastructure like highways, railways and a supply of direct and oblique employment. Ports generate alternate inside the hinterland thru logistic companies and other modes of transport, enhancing the shipping network, acting the feature of essential a part of the logistic intermodal techniques in global alternate.

Regardless of the quantity of investigations on the productivity of container terminals, most studies are of developed nations, and very few are of developing nations, like India.

Indian container terminals are extremely basic because of their area advantage and their capacity to handle transhipment traffic. There is a need to comprehend their performance at the low level, explicitly the terminal level instead of that of the entire port. Here is the investigation of the specialized effectiveness of compartment terminals in India utilizing an information envelopment examination approach for the last few years deciphers it as for area advantage, regulatory control and private control of terminal activities.

This study empowered the positioning of these terminals concerning their exhibitions. The general proficiency of compartment terminals on the west shore of India is viewed as better compared to that of the east bank of

India, and the productivity of container terminals working under significant ports is on a declining way when contrasted and that of non-major ports. The private interest has additionally not seen comparable efficiency changes across all container terminals.

Among the seven high performing container terminals distinguished through the examination gave, the terminal at Tuticorin arose as the most reliable one with regards to relative proficiency and development in complete variable efficiency. The predominant component affecting the productivity of a terminal is viewed as the size of the terminal, offering the benefits of economies of scale.

The ports have a top-notch role in influencing the neighbouring international locations and their position extends beyond the geographical boundary of the US in particular, they significantly have an effect on the diverse financial sports of landlocked international locations.

The port overall performance and performance alongside the logistic deliver chain control will control the price of numerous services in the land locked neighbouring international locations.

High transit costs, which may additionally consist of financial charges, or charges in time, may also in the end suppress merchandise sports of landlocked international locations. this can badly affect their financial development, and development on the kingdom that is illustrated with the aid of the disparity in change volumes (60% decrease) and transportation fees (50% higher) in landlocked countries than in port website hosting nations (UNCTAD, 2003) even though, it is possible that the port international locations make contributions to these high fees thru popular inefficient port services, the cutting-edge state of affairs is step by step converting. allowing the personal participation within the maritime zone is developing opposition among the neighbouring ports, which in turn make the port government and governments to take strategic choices so one can maintain their clients inside the landlocked international locations.

At the end of the financial year 2020, the average turnaround time (TRT) for ships across major ports in India stood at around 2.1 days. The average TRT was influenced by a variety of factors, including parcel size, cargo type, and entrance channel. For practically all of the main ports, this value had improved over the previous year Container terminals in India

Indian container terminals

Major and minor ports are classified according to their strategic importance and administrative authority.
Minor ports are controlled by state government marine boards and are supervised by the Indian Ports Act 1908 and the Major Port Trusts Act 1963, whilst major ports are controlled by the Ministry of Shipping (i-maritime, 2003) Port governance in India is moving from a service port model to the landlord port model, and complete privatisation has not been proposed due to a perception of a monopoly in trade and logistics (Brooks, 2004).

The port model is classified as a public service port if the infrastructure, superstructure, labour and other functions are owned and managed by a port authority.

These models are centred on the public's interests. When the operations are controlled by a private organisation with the port authority functioning as a regulator, the port model is classified as a landlord port. Landlord port model focusses on the mixed interests by public and private. The port is defined as a private service port if it is regulated, operated by a private entity, and focused on private interests (The World Bank, 2016).

Port container traffic[12]

In 2020, 815.6 million TEUs of containers were handled in ports worldwide. Between 2019 and 2020, global container port traffic fell by 1.2 percent.

In comparison to other shipping industry categories and total seaborne trade, this decrease is minor. This demonstrates the containerized trade's resiliency in the face of the COVID-19 interruption.

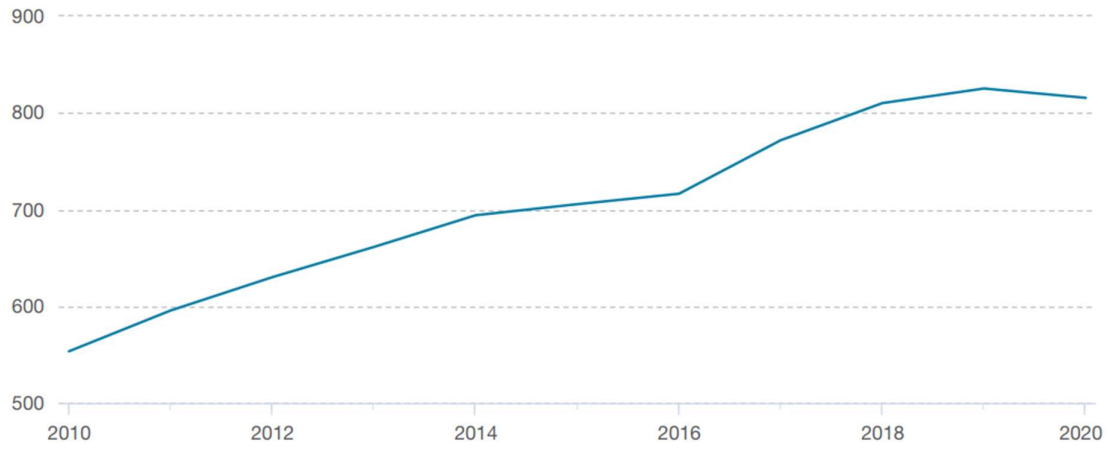

Fig. World container port throughput.

The region's strong contribution to containerized port throughput reflects Asia's dominant role as a worldwide maritime freight loading and unloading centre and its high liner shipping connectivity. Asia and Oceania's rising economies carried 509 million TEUs of containers in 2020, accounting for 62% of global port container traffic. The shares of developing America and developing Africa, at 7% and 4%, respectively, were much smaller. The developed economies made up 26% of the total.

1990-2020 average turnaround time at major Indian ports[13]
at Mangalore port

[12] https://unctad.org/system/files/official-document/tdstat46_FS15_en.pdf

[13] • India: turnaround time at major ports 2020 | Statista

The average turnaround time for vessels at the Mangalore port in the Indian state of Karnataka was less than two days in fiscal year 2020. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at V.O. Chidambanar port**

In the financial year 2020, the average turn round time for ships at the V.O. Chidambanar port in the state of Tamil Nadu in India was 1.67 days. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Haldia Dock Complex**

At the end of the financial year of 2020, the average turn round time for ships at the Haldia Dock Complex in India was around 2.8 days. This port's turnaround time is now half of what it was 20 years ago. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Mormugao Port**

The average turn around time for ships at the Mormugao port in the Indian state of Goa was 2.33 days in fiscal year 2020. There was an increase in the amount of time required to handle both conventional and mechanical dry bulk cargo, thereby increasing the overall turn round time at this cargo.

- **at Paradip port**

The average turnaround time at India's Paradip port was just over 2.3 days at the conclusion of the financial year 2020. In 2020, the South

Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Deendayal port**

In the financial year 2020, the average turn round time for vessels at the Deendayal port in the Indian state of Gujarat was a little over 2.5 days. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Vishakhapatnam port**

At the end of the financial year 2020, the average turnaround time at the Vishakhapatnam port in the Indian state of Andhra Pradesh was just over 2.4 days. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Kamarajar port**

At the end of the financial year 2020, the average turnaround time at the Kamarajar port in the south Indian state of Tamil Nadu was less than two days. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at JNPT (Nhava Sheva)**

In the financial year 2020, the average turnaround time for ships at the Jawaharlal Nehru or Nhava Sheva port in the state of Maharashtra in India was just over 1.2 days. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Kolkata Dock System**

In the financial year of 2020, the average turnaround time for ships at the Kolkata Dock System in India stood at more than three days. Over the last 20 years, the turnaround time has decreased significantly, from over 12 days in 1991 to little more than three days in 2020. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight.

- **at Cochin port**

The average turn around time for vessels at the Cochin port in the Indian state of Kerala was less than 1.5 days in fiscal year 2020. In comparison to the previous financial year, when the turn around time was 1.94 days, the turn around time that year was slightly shorter. In 2020, the South Asian country's port sector handled over 1.3 billion metric tonnes of cargo. The major ports handled a large percentage of this freight..

The average turnaround time (TRT) for ships across major Indian ports was roughly 2.1 days at the end of the financial year 2020. The average TRT was influenced by a variety of factors, including parcel size, cargo type, and entrance channel. For practically all of the main ports, this value had improved over the previous year.

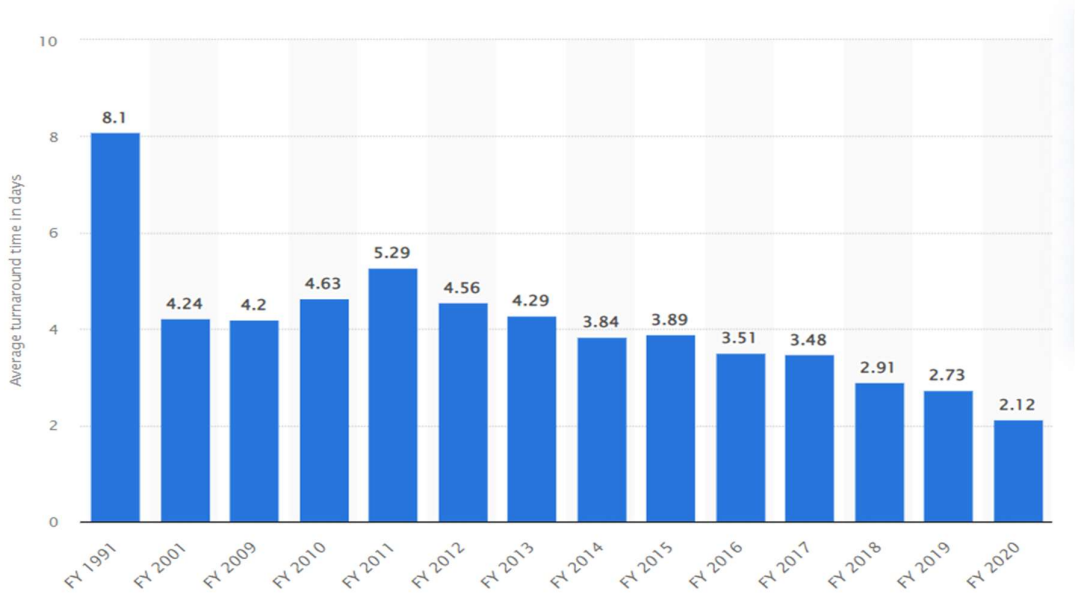

Fig. Average turnaround time across major ports in India from financial year 1991 to 2020 (Source: Statista)

Sl. No.	Port	Average Turn round Time/(Hours)	
		2018-19	2019-20 (upto December, 2019 (*)
1	Kolkata	92.08	98.64
2	Haldia	72.96	83.28
3	Paradip	60.35	73.05
4	Visakhapatnam	60.22	60.28
5	Chennai	47.41	48.21
6	V.O.Chidambaranar	47.04	46.80
7	Cochin	35.21	35.76
8	New Mangalore	46.21	46.50
9	Mormugao	63.06	66.78
10	Jawaharlal Nehru	51.22	50.88
11	Mumbai	60.42	62.39
12	Deendayal (Kandla)	72.24	72.24
13	Kamarajar (Ennore)	47.27	46.42
Total (All Ports)		59.51	62.47

Fig. Average turnaround time across major ports in India (2019-20)

(Source: Shipping annual report [14])

[14] https://shipmin.gov.in/

Chapter 4

Discussion and Findings

The oceanic transportation is reached to a progressive phase where the world's ports acquiring significance as they are the critical connection between the maker and the customer.

The expense decrease has been accomplished through the financial matters of scale by sending exceptionally huge mass transporters and compartment vessels and with the variation of new advancements. Yet, presently, opportunity has arrived to look for economies in a more complex area of port activity and the board with a view to decrease in completion time of the vessels in ocean ports.

On the off chance that the best advantages acquired in the ocean transportation are to be moved to the end clients, the time lost in and around the port terminals are to be recuperated. Due to the quick expansion in the proper expense of present-day vessels, the time lost in the ports become impressively more costly. The degree to which the port time increments for a vessel of call is a vital thought for the decision of the port for a specific exchange. The current review points to research the completion times of vessels approaching to the New Mangalore Port. The time required to circle back of a vessel is included enormous number of constituent variables. Deferrals can happen during any of these activities due to the extraordinary intricacy and interrelation of the port framework and activities. No great explanation can be credited to the lacklustre showing of port or expanded vessel time required to circle back.

The created vessel time required to circle back improvement model relates time required to circle back with distinguished pre-berthing defer factors, Pre-initiation and post-beginning elements, Port imperatives, non-Port limitations, Vessel requirements, Environmental Constraints and accessible port offices.

Factors affecting the Turnaround time

The various factors which are responsible for the turnaround time (TRT) are identified from the real time data collected and from the ground truth verification.

Based on the activities involved in the turnaround process and the limits faced by a vessel calling on the port, the detected factors are then divided into seven categories. The following are the identified elements that affect vessel turnaround time.

Sl.No.	Category	Factors
1	Pre-Berthing Delay factors	Non-availability of berth Non-availability of tugs/crafts non-availability of mooring gangs Condition and capacity of tugs non-availability of pilots Pilots not ready Delay in pilot boarding Delay in notice to signal station. Bunching of vessels Draft restriction Unidirectional channel Night Navigation Channel Buoys Strike/stoppage Ships account Shipper's account
2	Pre commencement and post Commencement Factors (Documentation)	Customs Formalities inward Documentation inward Survey inward Immigration documentation Customs Formalities outward Documentation outward Sealing and Inspection Survey outward Departure formalities
3	Port Constraints	Holiday Recess Ullage Constrains Pipe line fittings Draft restrictions Shifting Time Non-availability of Berths Non-availability of Labor

		Non-availability of Ports crafts/Tugs Non-availability of cargo handling equipment's Non-availability of Pilots Lighting Equipment beak down Non-availability of labor gangs Shore tank change over Priority berthing Other vessel movement Strike/stoppage Power failure Shed congestion Breakdown of equipment Lack of storage/silos Any other factors
4	Non-Port Constraints	Want of Cargo Breakdown of equipment's Sampling Lab tests PHO's Role Immigration Waiting for shore side readiness Hatch arrangements Hatch opening/closing Nature of cargo. Trimming of cargo post loading Berth cargo evacuation truck turnaround Intermediate stoppage for shifting to other cargo Detained by MMD Bunkering Line changing process Any other factors
5	Idle Time at Berth	No work Holiday Recess Ports Equipment break down Power problems Labour breakup Stoppage for mock drill Break during shifts Shifting or evacuation of cargo from berth Any other factors
6	Environmental Factors	Weather/rain Tide Cyclone Night Navigation Any other factors
7	Vessel Constraints	Engine failure Lashing/unlashing Vessel advance berthing Vessel ullage constraints Hot water flushing Line flushing Tank value problems Vessel repair or its equipment's Pump capacity Waiting for ship side readiness Slope discharge Delay in sailing Any other factors

The research study addresses a main concern in the container terminal operations business through its effort to identify factors affecting

turnaround time of container terminal and what sort of relationships they are having with Turnaround Time. Looking at practical operations, there can be seen that number of factors that affect TRT with different levels of influential capabilities where some of the factors are within the control of terminal operators while some others are beyond their control.

From the view pint of terminal operators, they can take actions to enhance performance of their terminal operations to reduce turnaround time of container vessels by increasing productivity in Container handling activities are carried out with the goal of eliminating or reducing needless delays. Yet, terminal operators do not have any control over the influences that are beyond their control, which were recognized under two main categories as influences due to environmental related causes and constrains from customer shipping lines including move count. In this regard, the research study concentrated on factors under the control of terminal operators, with fifteen variables selected based on the findings of a literature analysis as well as the researcher's years of experience working at terminals in Indian major ports. Only 10 essential factors were chosen for in-depth study after highly correlated variables were excluded from the detected variables.

CHAPTER 5

Conclusion and Suggestions

The main objective of the research is to identify the factors that affects the turnaround time at container terminal of Indian Major Ports and to optimize the same.

About more than 100 factors are identified which contributes to the high TRT in the port terminal. These factors are grouped into seven categories based on the activities involved in the turnaround process and the constraints faced by a vessel calling on the port.

The main seven categories of TRT constraints are

i) Pre berthing delay factors,

ii) Pre- commencement and post commencement factors,

iii) Port constraints

iv) Non-port constraints

v) Idle time at berth

vi) Environmental constraints

vii) Vessel constraints.

The major constraints in the pre berthing delay categories are non-availability of berths, non-availability of pilots, non-availability of mooring gangs, etc.

In case of pre-commencement and post-commencement factors the main constraints that contribute to the increased vessel turnaround time are customs formalities, custom documentation both in inward and outward

movement of vessels, inspection, survey of the cargo and immigration documentation are some of the factors. The non-port constraints are limited to want of cargo in some cases, breakdown of equipment's and waiting for shore side readiness. Non-availability of labour gangs, port crafts/tugs, priority berthing of coastal cargo boats, and other vessel movement are the main noted port restrictions. The idle time at berth observed are break during the shifts, shifting of vessel from one berth to other for operational requirements and want of draft and ports equipment breakdown. The study revealed that, the major constraints that cause delays are: delay in loading and unloading operations and delay occur during pre-commencement and post commencement of turnaround process mainly in the documentation and custom clearance.

From the developed vessel turnaround time optimization model, in the year-on-year TRT module, one can generate the port performance indicators such has pre-berthing waiting time (PBWT), vessel turnaround time (TRT), Non-working time at berth (NWTB), Number of vessels handled, output per ship berth day (OSBD) and port productivity.

The model can also be useful in generating various MIS outputs required for the top port management such as Port Performance Indicators (PPI), cargo through put, number of vessels sailed/berthed etc. with respect to the category of cargo handled, berth wise, on daily/monthly/yearly basis. The top management can get the details by click on bottom using this module output. From the year wise analysis of TRT it is observed that the pre-berthing waiting time and service time contributes to the maximum percentage of vessel turnaround time in all the terminals in major ports.

On an average 35 to 40% of the total turnaround time the vessels are waiting at the anchorage point before entering into the port and around 45 to 55% of time is consumed in the service time with in the ports. The increased pre berthing waiting time is mainly attributable to insufficient port infrastructure like want of berths in case of liquid bulk cargo, want of mechanized loading and unloading systems.[xi]

Suggestions

The findings of the research show that the pre-initiation and post-beginning elements are the most powerful factors for the expanded completion time at the all the container terminals in Indian Major Ports.

These reason delays in berthing tasks, and vessels needs to invest more energy at the port.

Among the principal factors considered, the time taken by the buyers or their custom agents for finishing different techniques like payment of duty and enrollment of products with the traditions.

In huge number of cases, delays in payment of duty by the buyers or in the leeway cycle happen because of reasons, for example, scarcity of assets for clearances; this additionally contributes in postpone stacking/dumping process. The market theory by the dealers prior to setting merchandise free from the caretaker is likewise a reason for high TRT.

Besides, freight moving activity is likewise a powerful element for the TRT at the greater part of the terminals.

Terminal supervisors call attention to this issue, beyond their control as providing and dealing with the help time during stacking and releasing tasks and to decrease ideal time at billets. Port imperatives and non-port limitations are additionally having a significant commitment towards TRT yet how much significance shifts with the sort of ware. Hence, based on the present study, following suggestions were drawn for the better port management.

- To have proper coordination between various stake holders of the turnaround process like port authority, custom authority, shipping agents/vessel liners, port security and other agencies concerned in the documentation process during the pre-commencement and post commencement of loading/unloading operations of the cargo into the vessels. Further assistance for preparation of documents can be provided by the port management. At present, to prepare the

documents for export of goods, exporter has to directly go to the customs department and prepare the documents. This process takes time as the exporters will not be so aware of the procedures. As a result, it creates a delay for the preparation of documents and without the documents; the ship cannot sail from the berth. So a separate unit can be created at the port for customs liaison. This can make the process faster and preparation of documents can be started in advance once the ship has registered with the port for loading/unloading of cargo.

- Implementing computerised single window systems for issuance of various clearance and port entry passes with Enterprise Resource Planning (ERP) so that all the port users can get the clearance and port entry permission on line with least interference from the port staff.
- Proper scheduling for shift gang and supervision during work time and attendance of labour may be arranged by the traffic department. While scheduling gang per ship, the contractors who are in-charge of bringing labour to work should ensure that all the labours are available on the spot and shift should be scheduled such that there is no gap between each shift. The loss of time in between the change of shift of gangs and the operators may be minimised.
- Double cycle loading/unloading method may be adopted. Turnaround time of vessel includes the time taken to load and discharge cargos/containers. When loading and discharging a vessel, wharf cranes usually spend only half of their moves carrying a cargo/container. During the time of discharging, the crane comes without cargo while moving to the hatch of the vessel. During the time of loading, the crane is without load when returning to the wharf. Double cycling is the practice of making use of these "No Load" movements of cranes to carry a cargo/container, thus making the crane moves contributing to increased productivity, and there is a reduction in vessel turnaround time The number of moves required to turn the ship around is fixed with existing single cycling or status quo procedures, and does not depend on the order in which the crane acts on the ship's columns. With double cycling, however, the number of moves depends on the order of operations. As a result, the challenge of double cycling is one of work scheduling, or determining the best order to operate on the columns in order to reduce ship turnaround time. The advantages of twofold cycling are large for both hatched and hatch less ships, and they are unaffected by sequence limits.
- Properly planning and managing the pilotage services and informing the vessels to be prepared for boarding of pilots could minimize the

loss of time in pilot boarding and non-availability of pilots. The proper communication of date and time of boarding the vessel to the port pilots well in advance may also be recommended to avoid the loss of time due to non-availability of pilots on the specified date and time assigned to a particular vessel movement operation for inward/outward movement of vessels from the port area.

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- Research findings indicate that equipment operator's availability is also causing considerable delays. The terminal managers could properly schedule shifts with minimum interruptions to operations and introduce methods such as hot seat systems to avoid such delays.[15]
- Lack of storage area transfer equipment and wharf crane operating rate are the two most important factors for every terminal. Investing on more cargo handling equipment is the most direct suggestion to resolve this problem.[16]

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